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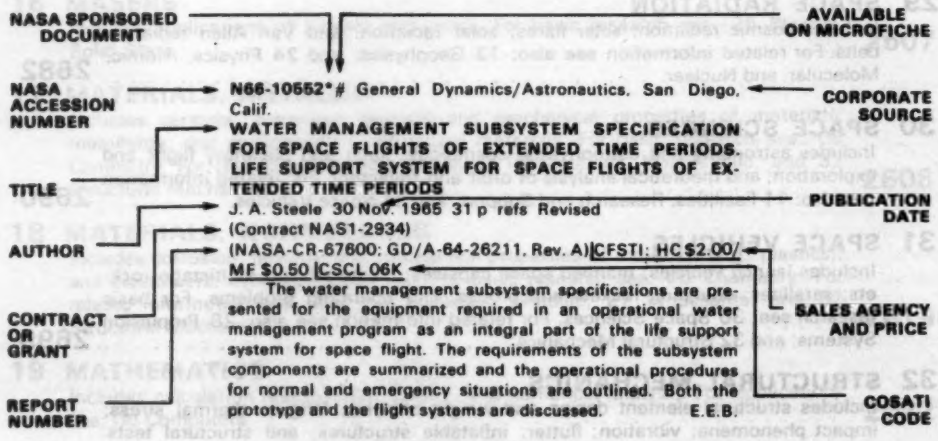
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NASA ACCESSION NUMBER
N66-10552*# General Dynamics/Astronautics, San Diego, Calif.
CORPORATE SOURCE
WATER MANAGEMENT SUBSYSTEM SPECIFICATION FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS. LIFE SUPPORT SYSTEM FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS
TITLE
PUBLICATION DATE
J. A. Steele 30 Nov. 1965 31 p refs Revised
AUTHOR
(Contract NAS1-2934)
CONTRACT OR GRANT
(NASA-CR-67600; GD/A-64-26211, Rev. A) CFSTI: HC $2.00/MF $0.50 CSCL 06K
SALES AGENCY AND PRICE
The water management subsystem specifications are presented for the equipment required in an operational water management program as an integral part of the life support system for space flight. The requirements of the subsystem components are summarized and the operational procedures for normal and emergency situations are outlined. Both the prototype and the flight systems are discussed.
REPORT NUMBER
E.E.B.
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VOLUME 4 NUMBER 14

Scientific and Technical Aerospace Reports

A Semimonthly Publication
of the National Aeronautics and Space Administration

July 23, 1966

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N66-25401# Aeronautical Research Labs., Melbourne (Australia).

SOME OBSERVATIONS OF BOUNDARY LAYER TRANSITION ON CONES AT SUBSONIC AND SUPERSONIC SPEEDS

D. G. Stewart and S. A. Fisher May 1965 68 p refs
(ARL/ME-267) CFSTI: HC $3.00/MF $0.75

This document records some observations which have been made to determine the point of boundary layer transition on cones of 5° and 25° semi-angle at Mach numbers from 0.4 to 1.83 and free stream Reynolds numbers of 0.14 to 1.30×10^6 per inch. Preliminary tests included the use of temperature recovery and wall pressure fluctuation measurement and later work made use of sublimation indicators (acenaphthene and azobenzene) and surface flow indications using titanium oxide in silicone. Other data on transition (both natural and artificial) have been examined and are compared with the results of the present work. It is concluded that transition distance in the present tests is smaller than that generally accepted for smooth cones and this is explained by the very low degree of surface roughness necessary to cause artificial transition under the present test conditions. Author

N66-25405# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany). Institut für Angewandte Gasdynamik.

ON SOME CONCEPTIONS OF ANALYTICAL APPROXIMATION METHODS BY WAY OF PHYSICAL CONCEPTS [UBER DAS AUFFINDEN ANALYTISCHER NAHERUNGS-WEGE MITTELS PHYSIKALISCHER VORSTELLUNGEN]

Friedrich Keune Mar. 1966 72 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-15; DVL-483) CFSTI: HC $3.00/MF $0.75

The zero-lift subsonic and supersonic flows around slender bodies and wings serve as calculatory examples. Universally valid approximation theories may be found if the concepts on the composition of flow around bodies with low aspect ratio are extended. The condition that the flow is to be derived only for given body shapes influences the character of the analytical method considerably and makes it much more difficult. With these two viewpoints in mind, this report reviews chiefly the author's publications on theories of flow around bodies of low aspect ratio and no longer small aspect ratios. The latter generalization of the analytic method on bodies with finite span at the trailing edge serves as a basis for determination of the flow around composed body or wing shapes. Author

N66-25418# Royal Aircraft Establishment, Farnborough (England).

THE PERFORMANCE OF LOW THRUST (0.05 N) VENTURI NOZZLES

B. P. Day Nov. 1965 40 p refs
(RAE-TR-65250) CFSTI: HC $2.00/MF $0.50

An account is given of experiments to determine the performance under transient and steady state conditions of a 0.05 N thrust nozzle for use with propane gas. It is shown that, with the inclusion of viscous effects in the flow equations, which is necessary at low thrust levels, the nozzle achieved the design performance at the operating plenum chamber pressure, but at lower pressures the performance deteriorated. Author

N66-25464# Royal Aeronautical Society, London (England). Transonic Aerodynamics Committee.

A METHOD FOR ESTIMATING THE PRESSURE DISTRIBUTION BETWEEN THE CREST AND THE TRAILING EDGE ON THE SURFACE OF AN AEROFOIL SECTION IN A SONIC STREAM

Nov. 1965 27 p refs
(TD-Memo-6511)

This method is based on theoretical relationships for sonic flow, modified and extended in applicability by empirical factors derived from an analysis of numerous experimental results. It gives reliable results for a wide range of aerofoil section shapes, but for aerofoils having zero or very small leading edge radius, the prediction of ω_{cr} may be in error for angles of incidence greater than 2°. The local flow characteristics on the surface of the aerofoil are determined in three stages, being expressed in each case in terms of the Prandtl-Meyer flow deflection angle ω. The three stages comprise the evaluation of ω at the crest, the evaluation of ω at the trailing edge, and the distribution of ω between the crest and trailing edge. In a fourth and final stage ω is converted to a pressure ratio, a pressure coefficient, or a local Mach number. Procedures are given for applying the method to the upper surface of an aerofoil for a given incidence, and with the

geometry specified in terms of coordinates and surface slopes. The method may be applied to a wide range of round-nosed lifting aerofoils and also, in a more limited extent, to sharp-nosed aerofoils. R.N.A.

N66-25466# Institut Franco-Allemand de Recherches, St. Louis (France).
RESULTS CONCERNING RADIATION EMITTED BY SOME PROJECTILE MODELS IN FLIGHT IN A HYPERBALLISTIC FIRING TUNNEL [RESULTATS CONCERNANT LE RAYONNEMENT EMIS PAR DES MAQUETTES EN VOL AU TUNNEL DE TIR HYPERBALISTIQUE]
S. Bihl and C. Lecomte 22 Dec. 1964 96 p refs In FRENCH; GERMAN summary
(ISL-T-45/64) CFSTI: HC $3.00/MF $0.75

Different origins of radiation emitted by a projectile in flight at velocities on the order of 4 to 8 km/s are investigated. This radiation was found to be greatly influenced by the configuration of the body and the type of material lining the tunnel. Energy emitted by air at high temperatures is calculated. Experimental results are assessed, and photographs are included which were taken with either optical (rocking mirror) or electronic (image viewing tube) speed correction. Spectra are shown under varying conditions of speed and pressure, and according to the nature of the atmosphere and the type of projectile. Dispersion, covered in the qualitative results, is considered very important. Transl. by R.LI.

N66-25470# Rome Univ. (Italy). School of Aerospace Engineering.
ESTIMATION OF THE AERODYNAMIC CHARACTERISTICS IN THE REALM OF VISCOUS INTERACTIONS [VALUTAZIONE DELLE CARATTERISTICHE AERODINAMICHE IN REGIME DI INTERAZIONE VISCOSA]
Ugo Ponzi and Massimo Trella Oct. 1965 58 p refs In ITALIAN
(Rept.-10) CFSTI: HC $3.00/MF $0.50

A modified procedure is described for evaluating the hypersonic configuration of air transport or reentry vehicles in relation to viscous interaction. Special attention is devoted to the investigation of flux on the top surface of the wing. The validity of the method is examined with regard to the presence of slip and viscous collision. Experimental results are evaluated based on recent findings at very high Mach numbers; a numerical analysis is presented, specifically in regard to the angle of attack. This method is considered appropriate to analyze the aerodynamic characteristics and to furnish other criteria for improving the wing system geometry. Transl. by R.LI.

N66-25495# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
TWO-DIMENSIONAL TUNNEL WALL CORRECTIONS FOR A WING WITH A BLOWN FLAP BETWEEN TWO PARALLEL WALLS
E. M. de Jager Jun. 1965 28 p refs Submitted for Publication
(NLR-TR-W.8) CFSTI: HC $2.00/MF $0.50

A linearized theory is developed to determine the pressure distribution on a wing with a jet-augmented flap between two parallel walls. The determination is performed by solving an integral equation numerically. Tunnel-wall corrections have been calculated for three values of the ratios wing chord to tunnel height and flap- to wing-chord. Author

N66-25550*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
CHARTS OF ADDITIVE DRAG COEFFICIENT AND MASS-FLOW RATIO FOR INLETS UTILIZING RIGHT CIRCULAR CONES AT ZERO ANGLE OF ATTACK
Vincent R. Mascitti Washington, NASA, May 1966 48 p refs
(NASA-TN-D-3434) CFSTI: HC $2.00/MF $0.50 CSCL 01A

Working charts are presented giving values of additive drag coefficient and mass-flow ratio for inlets utilizing axisymmetric cones at zero angle of attack. Cone half-angles range from 5° to 35°. The free-stream Mach number ranges from that which will yield sonic flow on the cone surface to 12. Perfect-gas relations are used throughout the calculations. Author

N66-25603# Deutsche Gesellschaft für Flugwissenschaften E.V., Brunswick (West Germany).
LIST OF REPORTS OF THE GERMAN RESEARCH ESTABLISHMENTS FOR AERONAUTICS AND ASTRONAUTICS FROM 1953 TO MARCH 1964 [VERZEICHNIS DER BERICHTE DER DEUTSCHEN LUFT- UND RAUMFAHRT-FORSCHUNGSANSTALTEN 1953 BIS MARZ 1964]
W. Schulz Sep. 1964 126 p refs In GERMAN; ENGLISH and FRENCH summaries
(DUR-Mitt.-64-01) CFSTI: HC $4.00/MF $1.00

This information contains a list of reports published by the German research institutions for Aero- and Astronautics—Aerodynamische Versuchsanstalt Göttingen (AVA); Deutsche Forschungsanstalt für Hubschrauber und Vertikalflugtechnik (DFH), formerly Deutsche Studiengemeinschaft Hubschrauber (DHS); Deutsche Forschungsanstalt für Luft- und Raumfahrt (DFL); Deutsche Versuchsanstalt für Luft- und Raumfahrt (DVL); Flugwissenschaftliche Forschungsanstalt München (FFM), formerly Deutsche Forschungsanstalt für Segelflug (DFS); Forschungsinstitut für Physik der Strahlantriebe (FPS)—after World War II, from 1953 till March 1964. The report series of the different establishments were substituted by a new common series entitled "Deutsche Luft- und Raumfahrt" on April 1st, 1964. This new series consists of two partial ones: "Forschungsberichte" (Reports) and "Mitteilungen" (Information). Author

N66-25610# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GAS EJECTOR
Yu. K. Arkadov 18 Feb. 1966 5 p Transl. into ENGLISH from Soviet Patent no. 171498 (Appl. no. 893301/24-6, 30 Mar. 1965) 2 p
(FTD-TT-65-1783/1+2+4; AD-630273) CFSTI: HC $1.10/MF $0.50

A nozzle design for a gas ejector to supply high and low pressure gasses is described. The nozzle is cut on the lines of a screw, whose pitch is equal to the wavelength of a supersonic jet. It is considered that this design gives optimal operation of the gas jet. N.E.N.

N66-25629# France. Ministere de l'Air, Paris.
ON THE ABSORPTION OF BLADING VIBRATIONS OF AN OPERATING TURBOMACHINE [SUR L'AMORTISSEMENT DES VIBRATIONS D'UN AUBAGE DE TURBOMACHINE EN FONCTIONNMENT]
J. L. Deschamps Serv. de Doc. Sci. et Tech. de l'Armement, Nov. 1965 103 p refs In FRENCH
(Rept.-421) CFSTI: HC $4.00/MF $0.75

A distribution of the aerodynamic singularities, characterizing the stability of a viscous flow, yields the aerodynamic forces in a blade commencing from the triangle of velocities. The method of concentrated masses permits the expression of the mechanical forces developed during the vibration. The transitory aerodynamic regime is characterized by a periodic deformation of the triangle of velocities, which modifies the expression of circulation in the permanent regime. With the alternating separation and joining at the point of the profiles, a supplementary term appears which is capable of changing the sign of the damping coefficient. Transl. by D.T.

N66-25643# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany).
THREE-COMPONENT-MEASUREMENTS ON AGARD STANDARD MODELS HB-1 AND HB-2 IN THE DVL GUN TUNNEL [DREIKOMPONENTEUMESSUNGEN AN DEN AGARDEICHMODELLEN HB-1 UND HB-2 IM STOSSWELLENWINDKANAL MIT FREIFLIEGENDEM KOLBEN]
Alfred Heyser, Wolfgang Wyborny, and Hans-Peter Kabelitz Apr. 1966 44 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-25; DVL-538) CFSTI: HC $2.00/MF $0.50

In the gun tunnel of DVL-Institut für Angewandte Gasdynamik measurements on AGARD-hypersonic ballistic standard Models HB-1 and HB-2 were carried out at Mach numbers M=8.75 to 15.4. Data were received by using three-component-balances based on strain gauge systems. The results are compared with measurements published by other institutes. Author

N66-25803# Institut Franco-Allemand de Recherches, St. Louis (France).
THE RING INTERCEPTOR AS COMMAND ELEMENT [DER RINGSPOILER ALS STEUERELEMENT]
M. Fiechter 28 Jan. 1965 18 p refs In GERMAN
(ISL-T-8/65) CFSTI: HC $1.00/MF $0.50

Three-component wind tunnel measurements were conducted on a cylindrical model with conical head at subsonic speed, with a ring spoiler perpendicular to the longitudinal axis of the model in various eccentrical positions. Aerodynamical effects were greatest when the ring spoiler was attached at the aft, where it was found to be a simple, effective control element for the model. Transl. by K.W.

N66-25852# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Research Lab.
SUPERSONIC STEADY AND UNSTEADY FLOWS OVER SLENDER AXISYMMETRIC BODIES WITH CONTINUOUS OR DISCONTINUOUS SURFACE SLOPES, PART I
Jerzy J. Kacprzynski Dec. 1965 90 p refs
(Grant AF-AFOSR-156-65)
(MIT Fluid Dyn. Res. Lab.-65-3; AFOSR-66-0132; AD-630425) CFSTI: HC $8.60/MF $0.75

The report contains the first part of an investigation aimed at finding methods for calculating steady and unsteady inviscid flows past slender three-dimensional bodies of general shape, with continuous or discontinuous slope, but with continuous cross-sectional area. The method is an extension of an approximation proposed by Lighthill (1948) in which the solution is based on the solution of Laplace transformed potential equation and is expressed by Bessel functions. Several characteristic functions, which lead to combinations of Bessel functions, were introduced and calculated. Considered are cases of axial steady flow and cross-flow past a body with discontinuities in slope, as well as unsteady flows for Mach numbers high enough so that it is possible to assume that $B^2=M^2-1\approx M^2$. The latter investigation induces flows with general unsteady boundary conditions, the body with a harmonically vibrating surface and the gust entry problem. Author (TAB)

N66-25858# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
THEORETICAL PREDICTION OF THE FLOW IN THE WAKE OF A HELICOPTER ROTOR. PART I: DEVELOPMENT OF THEORY AND RESULTS OF COMPUTATIONS Final Report, Sep. 1964–Sep. 1965
Peter Crimi Sep. 1965 93 p refs
(Contract DA-30-069-AMC-645(R))
(CAL-BB-1994-S-1; AD-629782) CFSTI: HC $9.60/MF $0.75

A study was performed with the objective of predicting the time-varying flow in the vicinity of a helicopter in hovering or forward flight. An analytical model was formulated which represents the rotor, its wake and the fuselage of the aircraft. The model for the wake has been simplified in a manner consistent with flow visualization studies by representing the wake as tip vortices emanating from each blade. The wake vortices are assumed to be free to convect under the influence of the blades, the fuselage and the wake itself. The fuselage has been replaced by a surface distribution of sources, the strength per unit area being determined by assuming that the fuselage is subjected to a uniform, steady free stream. A digital computer program was written which implements the model developed. Flow calculations were performed which agree well with measurements of the time average of the flow in the wake of a two-bladed rotor. Extensive calculations were then carried out which define the flow in the vicinity of a UH-1B helicopter for a range of flight conditions from hover to high-speed cruise. Upon analysis of the results, it was concluded that the model developed provides a valid representation of the unsteady flow in the vicinity of a helicopter. It was pointed out that the formulation is somehwat restrictive, in that the flow in the rotor plane and immediately adjacent to the fuselage cannot be accurately predicted. However, the suitable refinements incorporated, these regions could be investigated as well. Author (TAB)

N66-25953# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
A REVIEW OF RESEARCH ON THE INTERACTION OF A JET WITH AN EXTERNAL STREAM
C. C. Lee Mar. 1966 34 p refs
(Contract DA-01-021-AMC-11528(Z))
(R-184; AD-630294) CFSTI: HC $2.00/MF $0.50

A descriptive review is made of recent studies on the interaction of a jet with an external stream. Experimental data and empirical equations for the jet center line were reported. The existence of a pair of vortices in the jet flow was indicated. Further study, in order to determine the strength and location of the vortices either by acquistion of more data or by the development of the theory, is necessary. Author (TAB)

N66-26126# Joint Publications Research Service, Washington, D. C.
AVIATION ENGINEERING, NO. 2, 1963
22 Jun. 1965 192 p refs Transl. into ENGLISH of Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekh. (Kazan), no. 2, 1963 p 3–141
(JPRS-22668; OTS-64-21248) CFSTI: $3.00

Articles on temperature, gas and air flow, strength of materials and other calculations relating to aviation engineering are presented. For individual titles see N66-26127–N66-26145

N66-26137# Joint Publications Research Service, Washington, D. C.

CALCULATION OF LOSSES IN ANNULAR AXIALLY SYMMETRIC DIFFUSORS OF THE EXHAUST DUCTS OF TURBINE ENGINES

A. Ye. Zaryankin *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 85–94 refs (See N66-26126 14-01) CFSTI: $3.00

Certain relationships are obtained for annular diffusers formed by two conic surfaces. Consideration is given to the case of a flow without separation or twisting along the generatrices of the diffuser; an axially symmetric diffuser is depicted. Equations are formulated to express the various values. Results indicate the necessity of selecting the geometric ratios of the outer and inner cones so that the maximum degree of expansion of the diffuser may be obtained with a minimum increase in losses; provisions must also be made for a noninterrupted flow. M.G.J.

N66-26142# Joint Publications Research Service, Washington, D. C.

CALCULATION OF THE ARBITRARY REGIME OF A RADIAL-AXIAL TURBINE

A. P. Tunakov *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 137–144 refs (See N66-26126 14-01) CFSTI: $3.00

As an aid in evaluating the parameters of a turbine, a method is proposed for calculating the arbitrary regime of a radial-axial turbine. It is pointed out that the gas parameters at the intake to the turbine, i.e., the stagnation pressure, temperature, and static pressure at the outlet from the turbine are usually unknown; the number n of turbine rotor rpm's must also be assumed. From these parameters and the dimensions of the turbine blading, the flow rate of the gas through the turbine, its internal capacity, and internal efficiency may be determined. Three initial equations are written: the equation of conservation in gas dynamic functions, the law of conservation of energy, and the equation of connection for the stagnation temperature. An equation of the parabola is substituted in one formula; an ordinary quadratic equation is obtained, and the solution given. After determining the reduced velocity, the other parameters are found. M.G.J.

N66-26143# Joint Publications Research Service, Washington, D. C.

A MINIMUM-DRAG SELF-BALANCING PROFILE

Ye. V. Bulygina *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 145–152 refs (See N66-26126 14-01) CFSTI: $3.00

Consideration is given to the problem of a profile with given values of the lift factor and moment, and with minimum resistance in an ideal fluid at high supersonic speed. It is assumed: (1) In all supersonic speeds the pressure at any point on the surface is a function of the angle of incidence of the surface only at this point, and does not depend upon the pressure at other points. (2) For moderate supersonic speeds, the pressure is determined in accordance with the linear theory. (3) For high Mach numbers, the pressure may be represented by a series of degree, with the curvature of the shock wave line considered. (4) At hypersonic speeds, the pressure may be in accordance with Newton's theory, and refined by means of the pressure at the nose point. Only the lower surface of the wing is considered, with the lift of the profile determined by the summation of the vertical component of the forces of pressure, and the drag by the horizontal components. The moment of the profile is determined by the summation of the elementary moment from the vertical pressure component. The Lagrange multiplier method and the Euler equation are used in the solution. M.G.J.

N66-26231*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

FORCES INDUCED ON BODIES IN FREE WAKES AND THREE-DIMENSIONAL CAVITIES

J. Peter Reding Dec. 1965 36 p refs

(Contract NAS8-5338)

(NASA-CR-74998; LMSC-667990) CFSTI: HC $2.00/MF $0.50 CSCL 01A

Deformed wind tunnel models have been used in an experimental investigation of the loads on bodies in wakes, thus allowing the measurement of both local and wake source dependent submerged body loads. An analysis of these data reveal that the application of the separated to attached flow axial force ratio to the computation of the local Apollo command module load is valid. However, as the wake source to submerged body distance is increased a critical range is experienced where large induced upstream communication effects occur. These upstream effects amplify the loads dependent upon wake source conditions as well as those that result from the local submerged body crossflow, and could, therefore, seriously alter the vehicle dynamics. Author

N66-26325# Naval Ordnance Lab., White Oak, Md.

THE USE OF RATIONAL APPROXIMATIONS IN THE DIRECT CALCULATION OF SUPERSONIC FLOW PAST A BLUNT BODY OF REVOLUTION

Andrew H. Van Tuyl 15 Feb. 1966 44 p refs

(NOLTR-66-14; M-62; AD-630244) CFSTI: HC $4.60/MF $0.50

A method using rational approximations is presented for calculation of the supersonic axially symmetric flow of a perfect gas around a given blunt body. The method involves an iteration of the solution of the inverse problem, and matches the bluntness of the calculated body at the nose with that of the given one. The solution of the inverse problem is carried out using certain Pade fractions formed from the Taylor expansion of the stream function in the neighborhood of the nose of the shock. Rational approximations are obtained for the flow quantities on the body in terms of the arc length measured from the nose. In the present approximations, the computing time on the IBM 7090 is about sixty milliseconds for the solution of the inverse problem, and less than a second for the direct problem. Good agreement with measurements and other calculations is found in the subsonic region when the bluntness of the given body is less than or equal to that of a sphere. Examples indicate that the body should not be much blunter than a sphere in the present approximation if reasonable accuracy is desired near the sonic line.

Author (TAB)

N66-26354# Grumman Aircraft Engineering Corp., Bethpage, N. Y.

WIND TUNNEL TEST OF 1/7 SCALE MODEL OV-1 Final Report

Fred W. Shepheard Dec. 1965 80 p
(Contract DA-44-177-AMC-271(T))
(USAAVLABS-TR-65-73; AD-630924) CFSTI: HC $9.60/MF $0.75

Wind tunnel tests were conducted on a 1/7 scale model of the OV-1 airplane to determine the power-off drag, lift, and pitching moment coefficients of the model and its various components. Significant drag differences were measured between production canopy and nacelle configurations and streamlined fuselage and nacelle configurations, but are not considered applicable. No other significant drag differences were measured. Author (TAB)

N66-26378# Minnesota Univ., Minneapolis. Dept. of Aeronautics and Engineering Mechanics.
MODIFICATION OF THE ROBIN METEOROLOGICAL BALLOON. VOLUME II: DRAG EVALUATIONS Final Report, 15 Apr. 1963–30 Apr. 1965
H. G. Heinrich, R. J. Niccum, E. L. Haak, L. R. Jamison, and R. L. George 30 Sep. 1965 84 p refs Prepared for Litton Systems, Inc. *Its* Rept.-2873
(Contract AF 19(628)-2945)
(AFCRL-65-734(II); AD-629775) CFSTI: HC $8.60/MF $0.75

The drag coefficients corresponding to the Mach and Reynolds number conditions imposed on a light weight sphere (Robin) falling from 330,000 ft. to 260,000 ft. were established experimentally in the University of Minnesota supersonic low density wind tunnel. The Reynolds number was varied from 100 to 2,500, while the Mach number was varied from 1.2 to 3.17. In addition changes to previously reported subsonic values of drag coefficients due to improved testing techniques are included. The lift and drag coefficients of a rotating sphere in subsonic flow have been measured and are compared with analytically derived values. The tests were conducted with a 6 in. model and show variation of the lift and drag depending on the ration of the rotational and lateral velocities with limiting values of 0.5 and 0.6, respectively. Author (TAB)

N66-26412# ARO, Inc., Arnold Air Force Station, Tenn.
AERODYNAMIC FORCES ON A MODEL CONSTRUCTED FROM WIRE CLOTH IN LOW DENSITY HYPERSONIC FLOW
David E. Boylan Arnold Eng. Develop. Center, Apr. 1966 28 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-44; AD-630630) CFSTI: HC $2.00/MF $0.50

Measured aerodynamic forces on a satellite-type vehicle constructed from tungsten wire cloth are presented. The test medium was nitrogen, with a Mach number of 10.15 and a Reynolds number of 388/in. The feasibility of using force models of this type is demonstrated. Because no other data on such a model are available to the author, no detailed comparison of aerodynamic features is offered. Drag coefficient at small angle of attack was found to be approximately the same as a roughly similar shape of nonporous construction, but corresponding lift coefficient slope was markedly reduced by the porosity. Author (TAB)

N66-26491# Ballistic Research Labs., Aberdeen Proving Ground, Md.
BASE PRESSURE MEASUREMENTS ON SHARP AND BLUNT 9° CONES AT MACH NUMBERS FROM 3.50 TO 9.20
Neil A. Zarin Nov. 1965 36 p refs
(BRL-MR-1709; AD-630329) CFSTI: HC $3.60/MF $0.50

Base pressure measurements were made on sharp and hemispherically blunted 9° cones at Mach numbers from 3.50 to 9.20. The data obtained are compared to experimental data and to data from semiempirical analyses from other sources. An empirical correlation for the base pressure data is presented. The relative contributions of base and form drag to total drag are compared. Author (TAB)

N66-26496# RAND Corp., Santa Monica, Calif.
THE LONGITUDINAL AND LATERAL RANGE OF HYPERSONIC GLIDE VEHICLES WITH CONSTANT BANK ANGLE
S. Y. Chen Jan. 1966 52 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4630-PR; AD-629124) CFSTI: HC $5.60/MF $0.50

Approximate closed-form solutions for various flight conditions were obtained to determine both the longitudinal and lateral range of hypersonic glide vehicles with constant bank angle. Results for equilibrium glide vehicles with a constant lift-to-drag (L/D) ratio and small and slowly changing flight-path angle are presented in graphical form. Other approximate closed-form solutions are also obtained for glide reentry at very small flight-path angle, near-constant speed glide at high altitude, constant-deceleration glide at constant altitude, and constant-deceleration glide at fixed flight-path angle. The assumption of a very small flight-path angle results in a smaller range prediction than does the assumption of a small and slowly changing flight-path angle. This is especially true for prediction of the lateral range of vehicles with high lift-to-drag ratio. For a vehicle with an L/D of 3, entering at 0.98 orbital velocity and decelerating to 0.2 orbital velocity, the assumption of a very small flight-path angle results in predictions that underestimate lateral and longitudinal range by 22.6 and 22.5 percent, respectively, in comparison with the predictions based on the assumption of a small and slowly changing flight-path angle. In other words, completely neglecting the flight-path angle in the equations of motion leads to a conservative range prediction. Author (TAB)

N66-26569# ARO, Inc., Arnold Air Force Station, Tenn.
MASS TRANSFER AND FIRST-ORDER BOUNDARY-LAYER EFFECTS ON SHARP CONE DRAG
Clark H. Lewis, Ernest O. Marchano, and Herbert R. Little Arnold Eng. Develop. Center, Mar. 1966 63 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-37; AD-629955) CFSTI: HC $6.60/MF $0.75

A theoretical model is developed based on an iterated perfect gas inviscid-viscous flow field which includes first-order displacement (viscous interaction), transverse curvature, wall slip, and temperature jump in addition to mass transfer effects. The effects of inviscid (tangent cone) and viscous (non-similar laminar boundary layer) flow field matching conditions are also considered. The predicted viscous-induced pressure without mass transfer and the zero-lift drag with and without injection were in agreement with the experimental data within experimental uncertainty. The theoretical model was also used to predict zero-lift drag of a 9-deg half-angle cone at Mach = 9.37 and 10 and Reynolds number/in. = 400 to 45,000 for a range of wall-to-stagnation temperature ratios. Again, in general, without mass transfer the predictions were within experimental uncertainty. The inability of the theoretical model to adequately treat nonuniform mass transfer distributions is discussed. At the lowest Reynolds number the effects of

slip were most significant. At all conditions the effects of inviscid-viscous flow field matching were significant. Experimental zero injection equilibrium wall temperature distributions and cool-wall pressure data are given. Author (TAB)

N66-26572# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
AN ENGINEERING METHOD FOR RAPID CALCULATION OF SUPERSONIC-HYPERSONIC PRESSURE DISTRIBUTIONS ON LIFTING AND NON-LIFTING POINTED BODIES OF REVOLUTION AND SEVERAL SPECIAL CASES OF BLUNT-NOSED BODIES OF REVOLUTION **Final Report**
R. J. Vendemia, Jr. Nov. 1965 76 p refs
(Contract NOw-62-0604-c)
(TG-752; AD-630342) CFSTI: HC $3.00/MF $0.75

The method, which utilized hybrid tandem solutions involving Generalized Newtonian and Shock-Expansion theories, provides accurate results for a variety of nose shapes and fineness ratios over a range of supersonic/hypersonic Mach numbers. The numerical simplicity of the method, which makes it readily applicable for quick hand-calculational procedures, was the prime factor in its selection and publication. The investigation for lifting bodies indicates the present method is applicable for bodies of revolution at angles of attack up to about ten degrees. The report presents numerical examples showing stepwise calculational procedures for obtaining pressure coefficient and local Mach number distributions along the meridians of a body of revolution at angle of attack. TAB

N66-26595# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACCURATE LINEARIZED THEORY OF SUPERSONIC FLUTTER PANELS: SET UP OF PROBLEM AND GENERAL SOLUTION
Min-De Dun 3 Jan. 1966 38 p refs Transl. into ENGLISH from Scientia Sinica (Peking), v. 13, no. 3, 1964 p 391–412
(FTD-TT-65-1192/1+2+4; AD-626957) CFSTI: HC $2.00/MF $0.50

The report represents an effort of systematically investigating the flutter movement of panels on the basis of linearized theory at supersonic flow around. The report consists of five parts: (1) arrangement of problem and general solution; (2) theorem of subsistence; (3) autooscillations in near and hypersonic flow; (4) stability of multispan; (5) autooscillations of trapezoidal plate with consideration of finite effect.
Author (TAB)

N66-26705*# AVCO Corp., Wilmington, Mass. Research and Advanced Development Div.
THEORETICAL PREDICTION OF THE EQUILIBRIUM REAL GAS INVISCID FLOW FIELDS ABOUT BLUNT BODIES **Final Report**
Dec. 1963 24 p refs
(Contract NAS9-858)
(NASA-CR-75053) CFSTI: HC $1.00/MF $0.50 CSCL 01A

Theoretical two-dimensional and axisymmetric solutions to the blunt body flow problem at zero angle of attack are reviewed and compared to determine their suitability; these approaches consist of various approximate techniques for integrating the inviscid equations of flow in the subsonic or subsonic–supersonic region. Based on the findings, a method of integral relations was selected as most suitable for determining the three-dimensional flow fields. Equations are derived for the dividing streamline configuration to obtain sufficient data for the integration procedure. The three-dimensional program for equilibrium air is formulated, and the final equations and integration method appropriate for the one-strip analysis method are outlined. The problem is essentially reduced to determining the proper values of the stagnation point location and initial shock detachment distance, which will allow the solution to be continued through the two sonic point singularities. It is pointed out that emphasis was placed on obtaining a relatively simple method of computation in order to minimize programming difficulties, while retaining a level of approximation adequate for engineering purposes. M.G.J.

N66-26726# Aeronautical Research Council (Gt. Brit.)
LIST OF CURRENT PAPERS NUMBERS 651–700
London, HMSO, 1965 7 p refs
(ARC-CP-700) CFSTI: HC $1.00/MF $0.50

A bibliography is presented of publically available papers on aerodynamics and aeronautics. Author and date of publication are included. D.T.

N66-26727# Aeronautical Research Council (Gt. Brit.).
LIST OF CURRENT PAPERS NUMBERS 701–750
London, HMSO, 1965 7 p refs For abstract see N66-26726
(ARC-CP-750) CFSTI: HC $1.00/MF $0.50

N66-26841# ARO, Inc., Arnold Air Force Station, Tenn.
EQUATIONS AND CHARTS FOR THE EVALUATION OF FORCES ON SPHERICALLY BLUNTED CONES BY THE NEWTONIAN THEORY
L. L. Trimmer Arnold Eng. Develop. Center, Apr. 1966 41 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-16; AD-631149) CFSTI: HC $2.00/MF $0.50

Equations and charts are presented for the determination of the aerodynamic forces and moments of spherically blunted cones in hypersonic flow by the modified Newtonian theory. The equations are valid for cone half-angles from 0 to 90° and angles of attack from 0 to 180°; charts are presented for cone half-angles from 5 to 40° and angles of attack from 0 to 90°. A comparison of Newtonian theory predictions with experimental data is presented. Author (TAB)

N66-26859*# Bolt, Beranek, and Newman, Inc., Van Nuys, Calif.
A WIND TUNNEL INVESTIGATION OF PANEL RESPONSE TO BOUNDARY LAYER PRESSURE FLUCTUATIONS AT MACH 1.4 AND MACH 3.5
David Alan Bies Washington, NASA, May 1966 82 p refs
(Contract NASw-932)
(NASA-CR-501) CFSTI: HC $3.00/MF $0.75 CSCL 01C

This report describes blowdown wind tunnel experiments conducted on two well damped test panels which were designed and fabricated to measure panel response to boundary layer pressure fluctuations in the frequency range of high modal density. Panel response to a turbulent boundary layer under conditions of unperturbed and mildly perturbed flow at Mach 1.4 and 3.5 was measured. The response of the test panels to reverberant acoustic fields was also measured. Good quantitative agreement was obtained between theoretically predicted and measured panel response for cases of unperturbed flow. Panel acceleration response is in qualitative agreement with theory which predicts the existence of surface Mach waves. At Mach 3.5, fluctuations were of the order

of 6 dB more effective in driving the .022" thick panel than comparable reverberant acoustic fields. At Mach 1.4, two regimes were observed. In the low frequency range, a reverberant acoustic field was slightly more effective in driving the panels than were boundary layer pressure fluctuations. In the high frequency range, fluctuations were 7 or 8 dB more effective than the field. R.N.A.

N66-26873*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

FREE-FLIGHT AND FREE-OSCILLATION TECHNIQUES FOR WIND-TUNNEL DYNAMIC-STABILITY TESTING

Robert H. Prislin 1 Mar. 1966 40 p refs

(Contract NAS7-100)

(NASA-CR-75275; JPL-TR-32-878) CFSTI: HC $2.00/MF $0.50 CSCL 01A

This report presents the fundamentals of two wind-tunnel dynamic-stability testing techniques employed at the Jet Propulsion Laboratory: the free-flight technique, and the sting-supported free-oscillation technique. The techniques are described with reference to testing a body of revolution exhibiting planar motion. Emphasis is put on the data-reduction problem which arises when one considers nonlinear aerodynamic coefficents at arbitrary angles of attack. An approach to a general nonlinear case is outlined, and a detailed analysis is carried out for a cubic pitching-moment curve and arbitrary lift and drag curves. In addition, the advantages and disadvantages of utilizing the alternate testing methods are discussed. Possible extensions of both techniques into additional dynamic-stability testing areas are mentioned. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N66-25767# Aviation Safety Engineering and Research, Phoenix, Ariz.

PREPARATION FOR EVACUATION TESTS OF A CRASHED L1649 Final Report

Myron L. Braunstein and Mildred H. Piazza Jun. 1965 21 p

(Contract FA65-WA-1166)

(FAA-ADS-48)

Four aircraft evacuation tests were prepared using a previously crashed L1649 aircraft as the test vehicle. Two tests occurred in daylight and two at night. Spacing between rows of seats was varied from 39 to 32 inches. A number of items, such as cabin smoke, an external fire siren, and sound effects in the cabin were used to add realism to the test. Four "passengers" pretended to be incapacitated during each evacuation. Motion pictures inside and outside the aircraft and tape recordings of sound inside the cabin were taken during the evacuation. Each test utilized between 44 and 49 passengers and two experienced stewardesses, who responded to questionnaires concerning their experiences and reactions immediately after the evacuation. Author

N66-25773# Federal Aviation Agency, Atlantic City, N. J. National Aviation Facilities Experimental Center.

A STUDY OF AIR TRANSPORT PASSENGER CABIN FIRES AND MATERIALS

John F. Marcy Dec. 1965 58 p refs

(FAA-ADS-44)

A study of the combustion characteristics of aircraft cabin interior materials was made to establish the relative fire hazards. Tests were conducted on each of the cabin interior materials used in a four engine civil transport to determine their flammability, smoke and toxic characteristics; and fire tests were conducted "in situ" inside an airplane fuselage at different locations to determine the relative ease with which the materials would ignite and burn. Time for self-ignition, rapidity of flame spread, extent of burned area, smoke and toxic gas produced were obtained. The most important factor affecting the degree of fire hazard present inside an aircraft cabin was the flammability of the material in which fire originates. Materials which have superior self-extinguishing properties are poor ignition sources and confer a high degree of fire protection to the aircraft interior. In the large-scale fire tests, it was shown that the interior materials used in a passenger cabin can produce a flash fire with little or no warning. Heat, smoke and toxic gases generated by the fire up to about the time of the flash fire were low compared to human survival limits. Author

N66-25797# Aeronautical Research Labs., Melbourne (Australia).

INTERFERENCE EFFECTS IN MULTI-ENGINE SUPERSONIC AIRCRAFT

D. G. Stewart and Belinda Harrison Nov. 1964 44 p refs

(ARL/ME-264) CFSTI: HC $2.00/MF $0.50

The problem of interference between adjacent engines of multi-engine supersonic aircraft is considered. The integrated (e.g. Concord) layout is considered briefly and qualitatively. Interference could arise through slow spill operation but is avoided with over-rapid spill operation by the use of a dividing baffle. The podded layout is considered quantitatively in some detail. The shape of external shock waves, their movement upon engine failure, and the effect of this on performance of a second engine, are calculated for two basic forms of podded engine layout. It is concluded that, under some circumstances, compressor surge or intake buzz could occur in the second engine if spill operation in the first is too slow. Author

N66-26074# Federal Aviation Agency, Washington, D. C. Aircraft Development Service.

STABILITY OF STRUCTURE FOLLOWING BIRD STRIKE

Robert H. Ahlers Mar. 1966 41 p refs

(FAA-ADS-60)

Standard tail surfaces from a piston-engine, turboprop and jet-type transport aircraft were subjected to bird strikes to determine the size of the bird that would cause structural failure when impacted at speeds ranging from 135 to 378 mph. Then the leading edges of the piston-engine and turboprop airplane stabilizers were modified by the incorporation of various structural reinforcements, and bird strike conditions used on the standard surfaces were duplicated to obtain a direct comparison of the vulnerability of the standard and modified structures. Test results showed that the vertical stabilizer of the jet-type transport was the most resistant to bird strikes of all the tail surfaces tested; the stabilizer for the piston-engine aircraft was more resistant to bird strike

damage than the standard stabilizer for the turboprop aircraft by virtue of having two load-bearing spars with other internal structure which more effectively absorbed the impact energy of the bird; and the stainless steel doubler was the most effective of the trial modifications made to the leading edge. Author

N66-26078# Lockheed-California Co., Burbank.
DEVELOPMENT OF A POWER-SPECTRAL GUST DESIGN PROCEDURE FOR CIVIL AIRCRAFT
Frederic M. Hoblit, Neil Paul, Jerry D. Shelton, and Francis E. Ashford Washington, FAA, Jan. 1966 325 p refs
(Contract FA-WA-4768)
(FAA-ADS-53)

Three alternate forms of gust loads criterion based on power-spectral concepts are developed. These include a mission analysis criterion, a design envelope criterion, and a criterion combining advantages of each. The latter is recommended for design use. The determination of a design load level involves dynamic gust analysis of three airplanes, taking into account the significant rigid body and elastic modes, for both vertical and lateral gust inputs, as well as detailed stress analysis to the resulting loads. Two techniques have been developed for integrating the statistical determination of loads with the detailed stress analysis. One is the matching condition technique, in which design conditions are generated to closely envelope the statistically defined loads, with phase relations of the various load or stress components properly accounted for. The other is the joint probability technique, in which the joint probability density of axial and shear stresses is determined at all potentially critical locations in the structure and related to the respective strength envelopes. The sensitivity of results to variations in input data is investigated. Author

N66-26275*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN EXPLORATORY INVESTIGATION OF FACTORS AFFECTING THE HANDLING QUALITIES OF A RUDIMENTARY HINGELESS ROTOR HELICOPTER
Robert J. Huston Washington, NASA, May 1966 41 p refs
(NASA-TN-D-3418) CFSTI: HC $2.00/MF $0.50 CSCL 01C

A flight investigation was conducted to study the handling qualities of a rudimentary hingeless rotor helicopter. The results indicate that the control characteristics were generally good with positive and precise pitch control. The roll control response was generally good but pilots objected to a pitch-due-to-roll angular-velocity coupling. The coupling was shown to be predictable and methods are available to minimize the coupling. The hingeless rotor helicopter was found to have positive maneuver stability and good damping of moderate gust disturbances up to the maximum speed obtainable. Author

N66-26313# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE SILVERY CIGARS (DIRIGIBLES) ARE BEING PREPARED FOR OPERATION
Yu. Dmitriyev 12 Oct. 1965 15 p Transl. into ENGLISH from Nauchno-Tekhn. Obshchestva SSSR (Moscow), no. 4, 1965 p 43–45
(FTD-TT-65-744/1+2+4; AD-622454) CFSTI: HC $1.00/MF $0.50

This article discusses renewed Soviet interests in dirigibles. A short history of Soviet dirigibles is included, some of the dirigible's advantages are given, reasons for its discontinued use are mentioned, and present plans to begin dirigible construction are discussed. R.N.A.

N66-26605# Litton Systems, Inc., St. Paul, Minn. Applied Science Div.
FREE BALLOONS WITH OFF-DESIGN PAYLOADS Scientific Report No. 2
Justin H. Smalley 31 Dec. 1965 40 p refs *Its* Rept.-2927
(Contract AF 19(628)-5131)
(AFCRL-66-21; AD-629773) CFSTI: HC $3.60/MF $0.50

The membrane equations for an axisymmetric balloon and the equation of equilibrium are modified for application at conditions other than the design payload and design altitude. Examples are presented which show the change of shape, stresses, volume and float altitude resulting from payloads different than the design value. It is shown that, for payloads greater than the design value, local radius decreases everywhere so that no fullness is required to maintain zero circumferential stress. For payloads less than the design value, circumferential stresses are developed in the fully tailored portions. Author (TAB)

N66-26622# Litton Systems, Inc., St. Paul, Minn. Applied Science Div.
MODIFICATION OF THE ROBIN METEOROLOGICAL BALLOON. VOLUME I: DESIGN AND TEST Final Report, 15 Apr. 1963–30 Apr. 1965
J. H. Smalley and L. R. Flink 30 Sep. 1965 52 p refs *Its* Rept.-2873
(Contract AF 19(628)-2945)
(AFCRL-65-734(I); AD-629774) CFSTI: HC $5.60/MF $0.50

A program is described to modify the ROBIN meteorological balloon system to improve the inflatant capsule, to design a gaseous inflation system and to design a packaging canister. Capsule design was not greatly altered except to reduce the size of the orifices. The gaseous inflation system was found to be too costly. The canister design is entirely mechanical and, in chamber tests, has ejected and opened reliably. A series of altitude chamber tests and flight tests is described. The promise of the ROBIN system has not yet been fully realized. Author (TAB)

N66-26706# Hiller Aircraft Corp., Palo Alto, Calif.
HEAVY-LIFT TIP TURBOJET ROTOR SYSTEM. VOLUME VI: DYNAMIC AND AEROELASTIC STUDIES
Oct. 1965 52 p refs *Its* Eng. Rept.-64-46
(Contract DA-44-177-AMC-25(T))
(USAAVLABS-TR-64-68F; AD-624764) CFSTI: HC $3.00/MF $0.50

The studies pertain to dynamic and aeroelastic phenomena of the rotor system for a heavy-lift helicopter employing turbojet engines mounted at the tips of the rotor blades. A majority of the rotor blade frequency and blade flutter boundary work was accomplished using a lumped mass rotor blade simulation on a direct analog computer. The important results of these studies as well as other dynamic investigations which are necessary to insure adequate helicopter performance are included. Author (TAB)

N66-26707# Bell Helicopter Co., Fort Worth, Tex.
HIGH-PERFORMANCE UH-1 COMPOUND HELICOPTER MANEUVER FLIGHT TEST PROGRAM Final Report
James F. Van Wyckhouse Feb. 1966 101 p refs
(Contract DA-44-177-AMC-162(T))
(BHC-533-099-025; USAAVLABS-TR-66-17; AD-630927) CFSTI: HC $10.60/MF $0.75

The report presents the results of flight tests conducted with the USAAVLABS-Bell High Performance Compound Helicopter to extend its flight envelope, particularly with respect to maneuvers. Rotors with standard UH-1B and tapered tip blades were evaluated. With the tapered tip blades, the compound helicopter was flown to a true airspeed of 221 knots and the rise in power required and rotor controls load associated with compressibility was delayed by about .05 Mach number. Approximately 55 maneuvers, encompassing a velocity-normal acceleration envelope exceeding 2g's at 190 knots, were accomplished. The distribution of lift between the wing and rotor is defined and it is shown that the rotor provides the largest increase of normal load factor during the maneuver. Normal maneuver and structural limited rotor thrust coefficients are defined as a function of advance ratio and rotor propulsive force. Although rotor system dynamics, blade twist, planform, airfoil, etc., will influence these values of limiting thrust coefficients, it is believed that with proper interpretation the limits shown are generally applicable to all rotorcraft. Author (TAB)

N66-26735# National Aerospace Lab., Tokyo (Japan).
AN EXPERIMENTAL INVESTIGATION ON VERTICAL GUSTS AND THE AIRPLANE RESPONSE
Koichi Ono and Kosaburo Yamane 1965 28 p refs In JAPANESE; ENGLISH summary
(NAL-TR-89) CFSTI: HC $2.00/MF $0.50

Cross spectral method of analysis has been applied to flight test measurement of vertical gusts and the vertical acceleration response of a small twin-engine airplane. The response function obtained seemed to be independent of altitude and gust intensity in the frequency range up to 4 cps. Gust spectra were also obtained, which agreed very well with the theoretical expression. In addition, the frequency distributions of gust velocities were examined in several ways. The frequency distributions of gust velocities obtained from the total time spent above each level of gust velocities and the number of times each level of gust velocities was crossed in one direction coincided well. While the effect of eliminating the small amplitudes on r.m.s. gust velocities was negligible, the elimination affected the frequencies of level crossing counting and peak counting. These frequencies reduced with increasing the amplitude of eliminated waves. Author

N66-26779# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON AIR NAVIGATION TECHNIQUES [LITERATUUROVERZICHT LUCHTVAARTTECHNIER]
12 Apr. 1966 23 p refs In DUTCH, ENGLISH, and GERMAN
Its Vol. 14, No. L-294
CFSTI: HC $1.00/MF $0.50

Abstracts and bibliographic notes are presented on the topics of model descriptions, flight properties and achievements, propulsion, airports, upkeep, navigation and air traffic control, safety, training and personnel, aerodynamics, strength and vibration research, air cushion vehicles, landing gear, paints and finishes, and de-icing. Transl. by J.O.

N66-26849*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
MEASURED AND CALCULATED FLOW CONDITIONS ON THE FORWARD FUSELAGE OF THE X-15 AIRPLANE AND MODEL AT MACH NUMBERS FROM 3.0 TO 8.0
Murray Palitz Washington, NASA, Jun. 1966 48 p refs
(NASA-TN-D-3447) CFSTI: HC $2.00/MF $0.50 CSCL 01C

Impact-pressure and surface static-pressure measurements obtained from the X-15 configuration in flight and wind-tunnel tests are presented and compared with calculated results. Flight and wind-tunnel data are presented for angles of attack of 0° to 18° and 0° to 20°, respectively, and free-stream Mach numbers from 0.8 to 5.5 and 2.3 to 8.0, respectively. In regions near the body, the impact-pressure and surface static-pressure measurements from flight and wind tunnel at angles of attack were used to derive local Mach numbers. The results are compared with values obtained by using methods developed from simple flow models. The flight and wind-tunnel Mach number profiles for a detached-shock (spherical, or blunt, nose) configuration at zero angle of attack agree with numerical solutions of Moeckel-Love and Inouye-Lomax. Wind-tunnel impact and surface static pressures for an attached-shock (conical, or pointed, nose) configuration (free-stream Mach numbers of 4.7 to 8.0) agree with the method-of-characteristics solution for zero angle of attack. Author

N66-26857*# Arizona Univ., Tucson.
APPLICATIONS OF THE CALCULUS OF VARIATIONS TO AIRCRAFT PERFORMANCE
T. L. Vincent, F. Lutze, and T. Ishihara Washington, NASA, May 1966 41 p refs
(Grant NsG-580)
(NASA-CR-499) CFSTI: HC $2.00/MF $0.50 CSCL 01C

General equations which describe optimum flight trajectories in a plane for an assumed model aircraft are obtained by the use of the methods of calculus of variations. These general equations are presented in a form applicable for analog computer solution. A few typical two point minimum time trajectories are obtained using the analog computer for thrust only, drag only, and thrust and drag cases. Two interesting features are illustrated by these results: (1) optimal trajectories do not exist to all physically obtainable endpoints in the plane; and (2) for the cases which include drag, if the endpoint is a sufficient distance from the origin, then a portion of the flight trajectory is flown in a quasi-steady manner. The sensitivity of the solutions to certain unknown constants as a function of endpoint location is illustrated and discussed. Also some methods of making approximations to an optimal trajectory are outlined. Author

03 AUXILIARY SYSTEMS

Includes fuel cells; energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N66-25442# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
ON THE POSSIBILITY OF USING A PURE INERT GAS AS WORKING FLUID IN M.H.D.-GENERATORS [UBER DIE MOGLICHKEIT, M.H.D.-GENERATOREN MIT REINEM EDELGAS ALS ARBEITSMITTEL ZU BETREIBEN]

W. Ohlendorf Dec. 1965 58 p refs In GERMAN; ENGLISH summary
(IPP-3/29) CFSTI: HC $3.00/MF $0.50

A theory is developed for a non-equilibrium M.H.D.-generator using a pure inert gas as working fluid. Relaxation-times for the electron-drift-velocity, the electron-temperature and the recombination have been calculated. Author

N66-25478# Technische Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
H.E.R.O. (HAZARDS ELECTRO MAGNETIC RADIATION TO ORDNANCE) Bibliography
W. G. van Voss 15 Jan. 1966 45 p refs
(TDCK-43958) CFSTI: HC $2.00/MF $0.50

An annotated bibliography is compiled from the open literature in connection with the HERO program (Hazards Electromagnetic Radiation to Ordnance). Concerned primarily with hazards created by the ignition of explosive devices by electromagnetic radiation, the bibliography is divided into five chapters: (1) *Fundamental Reports*, (2) *Proceedings of the Second HERO Congress in 1963*, (3) *Measuring of Electromagnetic Radiation*, (4) *HERO Testing*, and (5) *Construction of Explosive Devices with RF Shielding*. M.W.R.

N66-25542*# Hamilton Standard Div., United Aircraft Corp., Broad Brook, Conn.
NONDISSIPATIVE DC TO DC REGULATOR-CONVERTER STUDY, PHASE I Final Project Report, 15 Jun. 1964–31 Dec. 1965
Frank L. Raposa [1965] 290 p refs
(Contract NAS5-3921)
(NASA-CR-74945; HSER-3140) CFSTI: HC $6.00/MF $1.50 CSCL 10A

Chopper and booster regulators were developed and breadboard testing was undertaken in connection with a study on a nondissipative DC to DC regulator-converter. Selection of a self-stabilizing chopper power supply was made for low voltages; and the control technique was a variable frequency, variable "on" time switching scheme in which "on" time is a function of input voltage. For high voltage output, a line compensated flyback booster was selected, with control by a fixed frequency switching scheme where the "on" time is a function of both input voltage and load. Nominal switching for both the chopper and booster series of power supplies was set at 30 KC. Eight breadboards were tested and evaluated at power levels of 10, 25, 50, and 100 watts for voltage regulation, efficiency, ripple, voltage output, and ripple current feedback. M.W.R.

N66-25563*# Space Ordnance Systems, Inc., El Segundo, Calif.
DEVELOPMENT OF AN ENVIRONMENTALLY IMMUNE ELECTROSTATIC INSENSITIVE APOLLO STANDARD INITIATOR Final Report
Gerald L. Drinkard 16 Nov. 1965 180 p *Its* Test Rept.-1112
(Contract NAS9-4147)
(NASA-CR-65352) CFSTI: HC $5.00/MF $1.00 CSCL 19A

Electro-static discharge protection for the Apollo standard initiator in deep space was investigated. Four of the seven initially proposed concepts have shown that additional protection with respect to inadvertant firing as a result of high static voltage pulses, has been increased. However, none of these concepts have provided protection with respect to changes in interbridge characteristics of the initiation mix. All post-pulse electrical tests were conducted at sea level conditions. Author

N66-25838# General Motors Corp., Kokomo, Ind. Delco Radio Div.
STUDY OF GERMANIUM DEVICES FOR USE IN A THERMOPHOTOVOLTAIC CONVERTER Progress Report No. 2, 1 Oct. 1965–1 Jan. 1966
D. P. Crouch and R. W. Beck Mar. 1966 97 p ref
(Contract DA-28-043-AMC-01420(E))
(ECOM-01420-2; AD-630394) CFSTI: HC $9.60/MF $0.75

Studies were made of the effects of surface adsorbed moisture on the performance of uncoated N on P+ and P on N+ devices. A preliminary evaluation of the effect of donor concentration variations in the N+ layer of the P on N+ device was made. The evaluation of the optical and electrical properties of anti-reflection coated devices supplied by four firms was completed. A study of the effects of moisture on the performance of antireflection coated devices was initiated. The influence of a vacuum environment on device performance was determined in the case of both uncoated and anti-reflection coated devices. A model which explains the performance behavior of devices under the influence of various ambient environments was presented and verified experimentally. P+ on N non-absorptive devices were fabricated by epitaxial deposition in the close-spaced transport system. The highest power output observed was 250 milliwatts-device. The presence of very high reverse saturation current limits the open circuit voltage but the short circuit currents are comparable to those obtained with absorptive devices. Author (TAB)

N66-26189# Los Alamos Scientific Lab., N. Mex.
SPACING AND CESIUM PRESSURE DEPENDENCE OF ELECTRON TEMPERATURES AND ION DENSITIES IN A THERMIONIC CONVERTER
Walter H. Reichelt and William L. Kruer [1965] 9 p refs Presented at the IEEE Thermionic Conversion Specialist Conf., San Diego, Calif.
(Contract W-7405-ENG-36)
(LA-DC-7390; CONF-651049-2) CFSTI: HC $1.00/MF $0.50

Electron temperature and ion density profiles in the interelectrode gap were determined spectrographically for a thermionic diode operating in the ignited mode for spacings of 1.0, 1.5, and 2.0 mm. At an emitter temperature of 1730°K, the cesium reservoir temperatures between 550 and 598°K, the maximum electron temperature and density were of the order of 2800°K and 5×10^{14} ions/cm^3, respectively. Electron temperature and density profiles near the emitter display a flattening or "turning down" which commences about 0.2 mm from the emitter. Departures from local thermodynamic equilibrium are not resolvable in the region of operation. Author (NSA)

N66-26234*# Atomics International, Canoga Park, Calif.
RADIATION EFFECTS ON SILVER AND ZINC BATTERY ELECTRODES, III Interim Report, Oct. 1965–Jan. 1966
M. M. Nicholson, H. L. Recht, G. Schlesinger, and W. A. Mc Collum 21 Mar. 1966 27 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951109)
(NASA-CR-74905; AI-66-33) CFSTI: HC $2.00/MF $0.50 CSCL 10C

The investigation of silver electrodes in experimental cells with cadmium counter electrodes was continued, with emphasis on the improvement of precision in the discharge capacity and gas evolution data. Steps have been taken for the closer standardization of discharge current density and depth of the conditioning cycle, for the reduction of ohmic drop effects in the recording and current control circuits, and

for the establishment of a well-defined gas atmosphere before the irradiation step. In closely matched cells at 90% state of charge, with capacity limited by the silver electrode, a capacity increase of 15% (±3%) was observed for the system receiving 7×10^7 rads (H_2O) of Co^{60} gamma radiation, while an increase of 12% (±2%) was observed for the control cell maintained at the same temperature. Hydrogen was detected in irradiated cells, and it was shown that a minor quantity of this product originated from the polystyrene cell liner and/or the electrolyte solution in the absence of electrodes. C.T.C.

N66-26249*# Electro-Optical Systems, Inc., Pasadena, Calif.
HYDROGEN-OXYGEN ELECTROLYTIC REGENERATIVE FUEL CELLS, APRIL 1-MAY 1, 1966
Martin G. Klein and Eugene Findl 10 May 1965 29 p
(Contract NAS3-2781)
(NASA-CR-75096; EOS-4110-ML-25) CFSTI: HC $2.00/MF $0.50 CSCL 10A

Single cells with various electrode structures and matrix materials were evaluated in order to increase cycle life and to gain a better understanding of deterioration modes. Preliminary results indicate that asbestos matrices are a major factor in performance degradation. After it was determined that no appreciable reaction takes place between potassium titanate and potassium hydroxide, it was decided to substitute potassium titanate for asbestos. Fabrication techniques were established. Multicell tests also indicate that the interaction of asbestos with the electrolyte contributes to poor performance. D.T.

N66-26274*# Gulton Industries, Inc., Metuchen, N. J. Alkaline Battery Div.
INVESTIGATION OF BATTERY ACTIVE NICKEL OXIDES Third Quarterly Report
P. Ritterman, S. Lerner, and H. Seiger 12 Mar. 1966 58 p refs
(Contract NAS3-7620)
(NASA-CR-54957) CFSTI: HC $3.00/MF $0.50 CSCL 10C

The X-ray diffraction patterns are shown which indicate no structural differences between discharged and up to 90% charged plates. The X-ray patterns of fully charged and overcharged electrodes show amorphous and γ-NiOOH structures. A pictorial view of the $Ni(OH)_2$ structure is presented. The X-ray patterns of plates after initial stands at 10°C, 25°C and 50°C are shown. Plates formed at C/30, 10°C; C/10, 25°C; and C/10, 80°C were compared for charge retention at room and elevated temperatures, and no significant differences were found. Cobalt doped positives were shown to be superior to pure $Ni(OH)_2$ controls on charged stand tests. Author

N66-26309# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
BASIC APPLIED RESEARCH IN FLUID POWER CONTROL Third Progress Report, 1 Jun.-15 Oct. 1965
S. Y. Lee, H. H. Richardson et al Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jan. 1966 110 p refs
(Contract AF 33(615)-2210)
(DSR-5293-3; AFFDL-TR-65-229; AD-630790) CFSTI: HC $10.60/MF $0.75

The report presents technical results and describes progress in several phases of continuing applied research and development related to the design and development of high-performance fluid control devices for advanced aerospace systems. Emphasis continues to be placed on pneumatic components and systems which are capable of performing, with high reliability, over wide ranges of temperature and in the presence of intense radiation. The report describes current work dealing with a differential pulse-length modulated gas servo, the dynamic modeling of fluid jet modulators, electrostatic fluid jet modulation, gas actuated accelerometers, fluid transformers, gas bearings, and the interaction of a fluid jet and a receiver diffuser. Author (TAB)

N66-26345# Electric Storage Battery Co., Yardley, Pa. Carl F. Norberg Research Center.
HIGH ENERGY SYSTEM (ORGANIC ELECTROLYTE) Quarterly Report No. 2, 15 Sep.-15 Dec. 1965
D. P. Boden, H. R. Buhner, and V. J. Spera Jan. 1966 99 p refs
(Contract DA-28-043-AMC-01394(E))
(ECOM-01394-2; AD-630691) CFSTI: HC $9.60/MF $0.75

The study of high energy density systems included: investigation of new electrolyte solvents; development of a technique for purifying propylene carbonate and other solvents; continued studies of corrosion and solubility of anode and cathode materials in various electrolytes; investigation of the effect of various fabrication and operating parameters on cathode performance; development of Li anode fabrication methods; and construction and testing of compact Li/CuF_2 cells. TAB

N66-26347# Stanford Univ., Calif. Dept. of Mechanical Engineering.
DIRECT ENERGY CONVERSION SYSTEMS. PART II: ELECTROCATALYTIC ACTIVITY OF HYDRAZINE IN FUEL CELL APPLICATIONS Quarterly Technical Report
P. D. Stonehart 30 Sep. 1965 67 p refs
(Contract AF 49(638)-1123; ARPA Order 246)
(AFOSR-66-0226; AD-628529) CFSTI: HC $3.00/MF $0.50

The electrode reactions of hydrazine in acid and basic solutions on smooth and platinised platinum were examined. From analysis of the rest potentials and concentration relationships a rapid one electron exchange with a stable surface species is postulated. The mechanism of oxidation occurs via a sequential system whereby hydrazinium radicals are the products of the initial oxidation. The electrode reactions of carbon monoxide in acid solutions on smooth platinum electrodes were also examined. The carbon monoxide is strongly bound to the metal surface and probably exists as a compound. Suppression of the reversible hydrogen reaction was observed in the presence of CO. Removal of the carbon monoxide film was performed as soon as oxide formation occurred indicating that the carbon monoxide is essentially electroinactive and that the reaction is purely chemical with the metal oxide to form carbon dioxide. Electrochemical regeneration of the metal oxide forms the regenerative cycle. $MO+CO>M+CO_2$; $M+H_2O>MO+2H^+ 2e^-$. The oxidation of methanol in acid does not proceed via carbon monoxide as an intermediate. Author (TAB)

N66-26348# Electric Storage Battery Co., Yardley, Pa. Carl F. Norberg Research Center.
HIGH ENERGY SYSTEM (ORGANIC ELECTROLYTE) First Quarterly Report, 15 Jun.-15 Sep. 1965
D. P. Boden, H. R. Buhner, and V. J. Spera Oct. 1965 82 p refs *Its* Rept.-1
(Contract DA-28-043-AMC-01394(E))
(ECOM-01394-1; AD-628961) CFSTI: HC $8.60/MF $0.75

The study of high energy density systems included conductance measurements of various non-aqueous electrolytes; corrosion and solubility studies of electrode materials in electrolytes; preparation of a reversible lithium reference electrode; fabrication and evaluation of lithium anodes and CuF_2, CoF_3 and CrF_3 cathodes; thermodynamic studies of the lithium–cupric fluoride cell; and kinetic studies of the cupric fluoride discharge reaction. TAB

N66-26542# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.
INVESTIGATION OF GERMANIUM DIODES FOR THERMOPHOTOVOLTAIC ENERGY CONVERTERS, SUPPLEMENT Final Technical Report, Sep. 15, 1965–Jan. 15, 1966
B. D. Wedlock, Atif Debs, Charles R. Hewes, and Robert Siegel [1966] 11 p
(Contract DA-44-009-AMC-625(T))
(AD-631038) CFSTI: HC $1.00/MF $0.50

The investigation of PIN thermophotovoltaic energy convertors continuing with emphasis on using evaporation techniques for the fabrication of back surface devices. The techniques have been developed to the point that junctions may be made with less than 5 mils separation. Work is proceeding to improve the lifetimes in the bulk material as a severe degradation at some point in the processing has kept the efficiencies below 1%. This problem is not expected to present important limitations since the techniques used have been utilized by other experimenters without encountering insurmountable difficulties. Planar devices are being fabricated to determine the applicability of the previously proposed theoretical solution. Author (TAB)

N66-26549*# Texas Instruments, Inc., Dallas.
DEVELOPMENT OF EPITAXIAL STRUCTURES FOR RADIATION RESISTANT SILICON SOLAR CELLS
Paul Gleim et al Washington, NASA, May 1966 138 p refs
(Contract NAS5-3559)
(NASA-CR-461) CFSTI: HC $4.00/MF $1.00 CSCL 10A

Experimental silicon drift-field solar cells were produced by means of advanced epitaxial and diffusion technology. Three different approaches were used for producing the drift-field structures and two different procedures were used for cell fabrication. Drift-field structures built by a single-epitaxial-deposit-and-diffusion technique and fabricated into cells by an improved procedure represent the best combination of methods by which a drift-field solar cell may be produced. Excellent reproducibility of cell characteristics and overall high process yields establish the production feasibility of this procedure to build drift-field solar cells. Author

N66-26553*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MATHEMATICAL MODEL WITH EXPERIMENTAL VERIFICATION FOR THE DYNAMIC BEHAVIOR OF A SINGLE-TUBE CONDENSER
Andrew A. Schoenberg Washington, NASA, Jun. 1966 53 p refs
(NASA-TN-D-3453) CFSTI: HC $3.00/MF $0.50 CSCL 10B

The condensation of the working fluid in Rankine power cycles was considered, and the derivation of a mathematical model used to predict the variations of the condensing pressure and isterface due to various disturbances in the process is presented. The model consists of transfer functions which were derived from the linearized form of the fundamental heat transfer and flow equations of the process. The break frequencies of the transfer function depend on the steady state operating point, and this condition is illustrated by changes in the experimental frequency response of the pressure and interface when the operating point is changed. It is reported that the same change is predicted by the model, thus giving evidence of its validity. The predicted frequency responses were found to be sensitive to several of the process properties, such as the heat transfer coefficients and the vapor and liquid pressure drop functions. Some of the values of the coefficients of the transfer functions for the cases investigated are small, and when neglected, a simpler form of the transfer functions is obtained. H.S.W.

N66-26557# Radio Corp. of America, Lancaster, Pa. Direct Energy Conversion Dept.
THE DEVELOPMENT OF A FLAME FIRED THERMIONIC GENERATOR Interim Technical Report No. 1, 15 Mar.–15 Oct. 1965
[1965] 76 p refs
(Contract DA-44-009-AMC-998(T))
(ERDL-998T-1; AD-629762) CFSTI: HC $3.00/MF $0.75

The report covers a seven month program to investigate components for flame fired thermionic energy conversion systems. The objective of the program is to demonstrate the feasibility of integrating a thermionic converter with a barrier layer and a heat pipe to obtain 1500 hour reliability of the assembly. A basic subassembly was designed to deliver 100 electrical watts from the thermal energy of a fossil fuel flame operating in an air environment. Twelve of these units would be used in the one kilowatt power module. Problems of heat transfer, permeation barrier integration, heat pipe processing and closure and burner temperature uniformity were encountered and substantially reduced or eliminated. The separate components were evaluated and determined to be satisfactory. It still remains to evaluate the complete assembly by life testing from a fossil fuel flame for a period up to 1500 hours. Author (TAB)

N66-26616# Eagle-Picher Co., Joplin, Mo. Couples Dept.
INVESTIGATIONS LEADING TO THE DESIGN AND DEVELOPMENT OF MAGNESIUM/MAGNESIUM PERCHLORATE BATTERIES First Quarterly Report, Nov. 1, 1965–Jan. 31, 1966
James R. Sharpe 28 Feb. 1966 43 p
(Contract DA-28-043-AMC-01763(E))
(NA-217; AD-630640) CFSTI: HC $4.60/MF $0.50

The report describes the significant accomplishments made on the research and development of magnesium/magnesium perchlorate batteries. Data are presented concerning electrical characteristics from −40°F to +125°F of magnesium/mercuric oxide six-cell batteries at low, medium and high rates. The variation of freezing point depression within the concentration range of 1 N. to 6 N. magnesium perchlorate was determined experimentally. Preliminary tests on manganese dioxide cathodes showed promise that further development can produce low cost cathodes with the same or better energy output as the costly mercuric oxide depolarizer. Author (TAB)

N66-26653*# Pennsylvania Univ., Philadelphia. Inst. for Direct Energy Conversion.
[RESEARCH IN THE CONVERSION OF VARIOUS FORMS OF ENERGY BY UNCONVENTIONAL TECHNIQUES] Status Report

Manfred Altman 1 Apr. 1966 157 p refs
(Grant NsG-316)
(NASA-CR-75115; INDEC-SR-7) CFSTI: HC $5.00/MF $1.00 CSCL 10A

Research activities and continuing investigations are reported in the following fields: plasmas, electron emission, and transport properties of ionized gases; electrochemical fuel cells, and transport properties in electrolytic systems; materials engineering; charged interfaces, solar-thermal energy conversion, and nonlinear heat transfer phenomena. N.E.N.

N66-26747*# Vickers, Inc., Torrance, Calif. Aerospace Div.
DEVELOPMENT OF A HYDROGEN-OXYGEN SPACE POWER SUPPLY SYSTEM
W. D. Morath [1966] 30 p
(Contract NAS3-2787)
(NASA-CR-75177; PR-91570-510-12) CFSTI: HC $2.00/MF $0.50 CSCL 10B

Prototype component development and engine endurance tests are reported. The design, fabrication, and assembly of the engine are mentioned, and design diagrams of components are included. The endurance tests are reported, and tables of component and engine failures are presented. N.E.N.

N66-26753*# General Electric Co., Schenectady, N. Y. Research and Development Center.
STUDY OF NICKEL-CADMIUM CELLS Third Quarterly Report, 17 Nov. 1965-17 Feb. 1966
[1966] 36 p
(Contract NAS5-9586)
(NASA-CR-75192) CFSTI: HC $2.00/MF $0.50 CSCL 10A

An investigation was continued of the behavior of the positive nickel hydroxide electrode with respect to its charging characteristics, gassing behavior, and charge retention, in an effort to develop nickel-cadmium cells with uniform capacity and operating characteristics. An additional two hundred anodes were processed through the initial six cycle, charge-discharge characteristics procedure. A data analysis showed that a representative capacity distribution curve was obtained for the entire lot tested to date. The capacities for 300 electrodes range from 950 to 1350 ma hrs; 90% of these have capacities between 1050 and 1250 ma hrs, with an equal spread over the four 50 ma hr increments. The rate of oxygen evolution was measured, and recorded, and the data were analyzed for three anodes each from the upper and lower ends of the distribution curve. All electrodes showed measurable oxygen evolution (1 to 2% of charge current converted to oxygen) at approximately 50% state of charge. At a 90% stage of charge the gassing rate values were in the range of 5 to 7%. D.T.

N66-26758*# Matrix Research and Development Corp., Nashua, N. H.
DESIGN AND DEVELOPMENT OF A NON-DISSIPATIVE CHARGE CONTROLLER USING A ROTARY TRANSFORMER Second Quarterly Report
[1966] 42 p
(Contract NAS5-9204)
(NASA-CR-75198) CFSTI: HC $2.00/MF $0.50 CSCL 10A

Limited progress was reported on the rotary transformer; and a prototype was assembled and partially tested. Part of the maximum power controller system was breadboarded and tested, including a pulse width multiplier and an ac current sample circuit. The problem of synchronous rectification of the transformer output was investigated; and results indicate that synchronous rectification will have to be ruled out because of the lack of a suitable semiconductor switch. In addition, a simpler technique of maximum power sensing; which will eliminate the need for a multiplier was devised, thereby reducing the number of components in the system by 20 to 25%. D.T.

N66-26772# Royal Aircraft Establishment, Farnborough (England).
PRELIMINARY DESIGN OF THE POWER SYSTEM FOR THE U.K. 3 SATELLITE Technical Memorandum, May 1964-Feb. 1965
M. Squires and R. C. Cook Jan. 1966 13 p refs Suppl. to RAE-TM-SPACE-50
(RAE-TM-SPACE-75; RAE-TM-SPACE-50) CFSTI: HC $1.00/MF $0.50

Design changes and parametric measurements of components for the electrical power supply system to be used for the U.K. 3 international earth satellite are reported. The general sub-system is schematically depicted. Major changes were made in the battery system, and the solar cell arrays. A table of monitoring instrumentation, relating to the subsystem; to the raw DC sources and to the battery of Ni-Cd storage cells is presented. L.S.

N66-26870*# Leesona Corp., Great Neck, N. Y. Moos Labs.
THE IMPROVEMENT OF ZINC ELECTRODES FOR ELECTROCHEMICAL CELLS Quarterly Report No. 3, 5 Dec. 1965-4 Mar. 1966
J. E. Oxley and C. W. Fleischmann [1966] 30 p refs
(Contract NAS5-9591)
(NASA-CR-75237) CFSTI: HC $2.00/MF $0.50 CSCL 10A

In addition to zinc, substrates of copper, silver, cadmium, tin, amalgamated zinc, and lead were investigated. The rate of dendrite growth varied with the substrate. In the case of activation-controlled deposition, the initiation period for dendrite growth also appeared to be a function of the substrate. After the same number of coulombs were passed, the weight of non-adherent deposit varied with cathode metal. The effect of Pb ions in the electrolyte was investigated. Optimum adherence and smoothness of deposit was obtained when the concentration of Pb(II) was about 0.5 g/l for both activation- and diffusion-controlled electrodeposits. Improved adherence of deposit was obtained by interrupting the charge with a partial discharge. This experiment showed that the sites of zinc dissolution need not be those of deposition during such a discharge-charge cycle. A discussion is included on the effect of the porosity of the positive electrode. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N66-25471# Albert-Ludwigs-Universität, Freiburg (West Germany). Medzinischen Klinik.

THE DIAGNOSIS OF DELAYED RADIATION DAMAGE TO THE HEMATOPOIETIC ORGANS FOLLOWING CHRONIC OCCUPATIONAL RADIATION EXPOSURE [ZUR DIAGNOSE VON STRAHLENSPATSCHADEN DER HAEMOPOETISCHEN ORGANE INFOLGE BERUFLICH BEDINGTER CHRONISCHER STRAHLENBELASTUNG]

F. Wendt and A. Preussler Brussels, EURATOM, Mar. 1966 114 p refs In GERMAN; ENGLISH summary
(Contract EURATOM-031-64-1 BIAD)
(EUR-2634.d) CFSTI: HC $4.00/MF $0.75

The effects of radiation on 13 occupationally exposed persons were investigated, by means of information from the occupational hazard insurance companies and other sources. The cases were divided into 4 groups according to the degree of damage, namely: (1) Minor reversible damage with temporarily lowered bone marrow cellularity and blood cell reductions (7 cases). (2) Medium reversible damage with longer term history of bone marrow hypoplasia and pathological blood cell values (1 case). (3) Severe irreversible damage with persistent bone marrow hypoplasia and pathological blood cell values (1 case). (4) Malignant hemoblastosis or other forms of neoplastic bone marrow disease. The probability was established that the effect of radiation was an essential pathogenetic factor in 4 cases: a reticulosarcomatosis, a subacute myeloblastic leukemia, a subacute lymphatic leukemia, and a lymphatic leukemia with transition to a reticulosarcomatosis. No unequivocally radiation-specific alterations were found. The diagnosis of radiation-induced damage to the hematopoietic organs from small radiation doses, such as occur in occupational exposure, can be made with adequate probability only after detailed and comprehensive investigation, and only from the totality of all unspecific symptoms. In this context a special significance is attached to exposure anamnesis, the subjective data of which must be supplemented by as accurate an individual dosimetry as possible. Author

N66-25526*# Public Health Service, Phoenix, Ariz. Communicable Disease Center.

LABORATORY FOR MONITORING BACTERIAL CONTAMINATION OF SPACE COMPONENTS Quarterly Report, Jan.–Mar. 1966

Apr. 1966 8 p *Its* Rept.-12
(NASA Order R-137)
(NASA-CR-74868) CFSTI: HC $1.00/MF $0.50 CSCL 06T

Studies relating to the recovery of microorganisms from solids are continuing, and the effect of various organic solvents on the viability of spores of *B. subtilis* var. *niger* was studied in an attempt to design a model system in which spores could be recovered quantitatively from plastic materials. Ethylene diamine was found to be extremely toxic to spores, but benzene, chloroform, freon, and several other solvents appear to be usable for recovering spores from suitable solids. The development of an efficient and reliable technique for removing microbial contaminants from surfaces was also studied, as was the survival of microorganisms on stainless steel surfaces and polystyrene granules. Other studies reported in brief deal with the comparison of levels and types of microbial contamination in industrial clean rooms and hospital operating rooms, recovery of sublethally heat-damaged aerobic and anaerobic spores, and microbial contamination from handling and fallout. M.W.R.

N66-25534# Joint Publications Research Service, Washington, D. C.

SOME PROBLEMS RELATING TO THE MECHANISM OF THE TOXIC EFFECT OF CARBON TETRACHLORIDE AND ITS HOMOLOGS

P. G. Garkavi 8 Apr. 1966 24 p refs Transl. into ENGLISH from Farmakol. i Toksikol. (Moscow), v. 29, no. 1, Jan.–Feb. 1966 p 118–124
(JPRS-34975; TT-66-31413) CFSTI: $1.00

A review of the literature points to the hepatotropic character of the toxic effect of carbon tetrachloride and its homologs. Experimental data relating to enzyme activity in blood serum, the make-up of blood and urine, and disruption of liver metabolism are cited. Suggestions offered to explain the toxicity of CCl_4 include: (1) the structural disorganization of the mitochondria disrupt enzyme metabolism; (2) enzyme disruption is connected with the utilization of energy rather than its production; (3) fatty dystrophy of the liver results from lack of glycogen, the accumulation of triglycerides, or disruption in lipoprotein formation; (4) sulfahydryl groups are blocked out; or (5) protein synthesis is inhibited. M.W.R.

N66-25548*# Spacelabs, Inc., Van Nuys, Calif.

DRY ELECTRODES FOR PHYSIOLOGICAL MONITORING

Charles W. Patten, Frank B. Ramme, and James A. Roman (NASA. Flight Res. Center) Washington, NASA, May 1966 40 p ref
(Contracts NAS4-390; NAS4-791)
(NASA-TN-D-3414) CFSTI: HC $2.00/MF $0.50 CSCL 06B

A method for very rapid application of electrocardiogram electrodes by spraying a conductive mixture is described. The electrodes are also suitable for electroencephalograms. All required equipment and the application procedure are described in detail. The finished electrode is dry and is less than 0.01-inch thick. Electrical and operational factors are not considered. Author

N66-25578*# National Aeronautics and Space Administration, Washington, D. C.

AEROSPACE MEDICINE AND BIOLOGY A Cumulative Index to the 1965 Issues of a Continuing Bibliography

April 1966 725 p refs
(NASA-SP-7011 (20)) CFSTI: HC $7.00/MF $3.50 CSCL 06E

Cumulative subject, corporate source, and author indexes are presented for the aerospace medicine and biology continuing bibliography. The subject index contains "see" and "see also" cross references. D.T.

N66-25606# Naval Radiological Defense Lab., San Francisco, Calif.

THE INCORPORATION OF TRITIUM FROM THYMIDINE INTO PROTEINS OF THE MOUSE

Bernard J. Bryant 21 Jan. 1966 26 p refs Work done in part at Brookhaven Natl. Lab.
(USNRDL-TR-971; AD-630331) CFSTI: HC $2.60/MF $0.50

Tritium from methyl-3H-Thymidine was found to be incorporated into proteins in mice. This incorporation in the mouse as a whole represented between 1 and 10% of the injected tritium. Triatiated water was not responsible for the labeling. Transmethylation reactions were proposed as a means whereby certain amino acids might have acquired the tritium from thymidine at some stage of its catabolysis. The initial (2-hour) ratios of DNA to protein tritium activities per

mg wet tissue ranged from 5 in two tissues of low DNA synthetic activity (pancreas, liver) to 35–40 in two tissues of high DNA synthetic activity (spleen, small intestine). Labeled nuclear protein was coincident with labeled DNA in nuclei, where it constituted less than 2.5% of the total tritium. The significance of the findings was discussed. Author (TAB)

N66-25609# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY AND PRACTICE OF IONIZED-AIR THERAPY
L. L. Vasil'yev 6 Jan. 1966 144 p refs Transl. into ENGLISH of the publ. "Teoriya i Praktika Lecheniya Ionizirovannym Vozdukhom" Leningrad, Izd. Leningr. Gos. Univ., 1951 132 p
(FTD-TT-65-590/1+2; TT-66-60830; AD-630415) CFSTI: HC $14.60/MF $1.00

Contents: Natural ionization of air, its climatological and hygienic significance; Artificial ionization of air, aeroion generators and counters; Therapeutic use of aeroionization (aeroiontherapy); Experimental bases of aeroiontherapy; Paths and mechanisms of the physiological effect of aeroions.
TAB

N66-25618# Naval Radiological Defense Lab., San Francisco, Calif.
THE EFFECT IN STOMACH OF IONIZING RADIATION ON ACID SECRETION, POTENTIAL, ADENOSINE TRIPHOSPHATE AND PHOSPHOCREATINE IN COMPARISON TO SPLEEN
Joseph T. Cummins, Herbert H. Kohl, and Burton E. Vaughan 21 Feb. 1966 24 p refs
(USNRDL-TR-980; AD-630390) CFSTI: HC $2.60/MF $0.50

Results using an In Vitro rat stomach preparation indicate that gastric acid secretion is stimulated through neurological pathways and induced by both handling and irradiation. The changes in acid secretion occurred independently of alterations in the sodium-potassium dependent potential across the stomach. Despite the two functional radiation effects, there were no gross changes in phosphorylative metabolism in rat stomach, otherwise adenosinetriphosphate and phosphocreatine would have been affected. At the same time, there was the expected irradiation change in spleen ATP, but the spleen phosphocreatine remained unchanged. The latter is a new observation which puts in question some aspects of the current cellular theory of splenic irradiation effects.
Author (TAB)

N66-25627# Aktiebolaget Atomenergi, Stockholm (Sweden).
CALCIUM AND STRONTIUM IN SWEDISH WATERS AND FISH, AND ACCUMULATION OF STRONTIUM-90
P-O Agnedal Apr. 1966 38 p refs
(AE-224) CFSTI: HC $2.00/MF $0.50

The purpose of this study has been to investigate the correlation between calcium and strontium in fish in relation to the concentration of these elements in the water. Lakes with calcium concentrations between 2–63 mg/l have been studied and samples from the Baltic coastal water are also included. Three fish species are studied, viz. pike (Esox lucius (L.)), perch (Perca fluviatilis (L.)) and roach (Leuciscus rutilus (L.)). Bones, muscle tissues, and skin + scales have been analysed. Measurements have been made showing an increase of strontium-90 in both water and fish. Calculations show that water with about 2 mg Ca/l a 10-fold increase of the existing strontium-90 level might give strontium-90 concentrations in fish muscle tissues close to what is permissible. In lakes with calcium concentrations 20–40 mg/l the permissible levels for drinking water will be exceeded before the fish consumption would have to be restricted. Author

N66-25660# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
OBSERVATIONS ON THE ULTRASTRUCTURE OF THE OZENATOUS NASAL MUCOSA
V. Casobati, F. Rosati Valente, and C. Silvagni (Rome Univ.) 5 Oct. 1965 70 p refs
(ISS-65/34) CFSTI: HC $3.00/MF $0.75

The authors have studied in the electron microscope the alterations of the nasal mucosa during the course of ozena. In the early stages the following was observed: (1) increase in the cytoplasmic digitations of the ciliated cells; (2) increase in the number of mitochondria in the basal layer; (3) appearance of wide spaces, filled with a non-mucinoid material, in the outermost layer of the epithelium; (4) increase in the number and thickness of the stomi of the vessel walls. In the advanced stages the following was observed; (a) increase in the thickness of the basement membrane and in the number of desmosomes; (b) endothelial changes in the vessels; (c) alterations of the collagen fibres; (d) appearance of mitochondrial aggregates in the basal layer of the epithelium; (e) changes in the Golgi apparatus in the muciparous cells and in the ergastoplasm of the serous glands; (f) appearance of characteristic oval-shaped structures on the free surface; (g) appearance of some bacteria in the crust. The authors comment on their observations and discuss the etiopathogenetic interpretation of ozena. Author

N66-25666# Army Natick Labs., Mass.
LONG-TERM STORAGE STUDY OF DISINFECTANT, GERMICIDAL AND FUNGICIDAL
Elizabeth Pillion, Arthur M. Kaplan, and Morris R. Rogers Dec. 1965 17 p refs *Its* Microbiological Deterioration Ser. No. 8
(AD-630432) CFSTI: HC $1.00/MF $0.50

A five-year storage test was conducted on Disinfectant, Germicidal and Fungicidal, Phenolic, Dry-Type Specification MIL-D-51061 in order to obtain data on storage stability and performance under adverse climatic conditions. The storage sites were located at Fort Churchill, Canada (arctic, cold-dry), Maynard, Massachusetts (temperature, cold-wet), Yuma, Arizona (desert, hot-dry) and Panama Canal Zone (tropic, hot-wet). After five years of storage in arctic and temperate climates the disinfectant showed no significant change in appearance or composition, and no decrease in bactericidal activity. The samples exposed in the hot environments showed varying degrees of alternation evidence by darkening and liquifaction of the dry powder. Bactericidal activity was lower than control values but sufficient to meet the performance requirements. Author (TAB)

N66-25677# Defence Research Board, Ottawa (Ontario).
AN APPARATUS FOR THE STUDY OF RESPIRATORY GAS METABOLISM IN SMALL ANIMALS
M. D. Hacaniuk Jan. 1966 11 p Transl. into ENGLISH from Fiziol. Zh. (Kiev), v. 1, no. 3, 1955
(T-3-UKR; AD-630483) CFSTI: HC $1.00/MF $0.50

This article describes a gaseous exchange apparatus designed for studying respiratory gas metabolism in animals. The apparatus determines the quantity of consumed oxygen and the amount of carbon dioxide breathed out. Its construction is based on a combination of a volumetric determination of the amount of absorbed oxygen, and a titration method of determining the amount of released carbon dioxide. Included are detailed descriptions of the equipment, its arrangement and operation, a sample carbon dioxide determination, and diagrams and photos of the apparatus. R.N.A.

N66-25762# Library of Congress, Washington, D. C. Aerospace Technology Div.
ENERGY TRANSFER IN PHOTOBIOLOGY AND PHOTOCHEMISTRY Surveys of Soviet Scientific and Technical Literature
Boris Martsissov 31 Dec. 1965 144 p refs Annotated Bibliog., Pt. 1 and 2
(ATD-B-65-102)

An annotated bibliography on energy transfer in both photosynthesis and vision is prepared from the Soviet open literature published between 1958 and 1963. The references, many with abstracts, are arranged alphabetically by author; and subject, author, and association indexes are appended. M.W.R.

N66-25782# Joint Publications Research Service, Washington, D. C.
PARTICIPATION OF BONE MARROW IN THE OXIDATION OF BENZENE
I. D. Gadaskina, Zh. I. Abramova, and T. P. Vikherskaya 23 Feb. 1966 14 p refs Transl. into ENGLISH from Gigiena'truda i Prof. Zabolevaniya (Moscow), no. 12, Dec. 1965 p 3–7
(JPRS-34258; TT-66-30899) CFSTI: $1.00

Experimental studies with rabbits reveal that bone marrow can oxidize benzene more effectively than liver can, and that leukocytes actively oxidize benzene. In the presence of chronic or subacute poisoning, oxidation occurs to a lesser extent than in the bone marrow from healthy animals. Excretion of glucoronides and bound sulfur in the urine is found to drop, after attaining a peak, in spite of continuing intoxication. This finding is considered to be indicative of the importance of bone marrow in benzene oxidation; and experimental confirmation is obtained with a leukocyte suspension which displays only traces of benzene following a two-hour period. M.W.R.

N66-25788# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
ACTION SPECTRA OF THE EFFECT OF ULTRAVIOLET RADIATION ON "IN VITRO" DNA OF PHAGE α [SPETTRO D'AZIONE PER L'EFFETTO PRODOTTO DALLA RADIAZIONE ULTRAVIOLETTA SUL DNA DEL FAGO α IRRADIATO "IN VITRO"]
M. Cremonese 17 Nov. 1965 40 p refs In ITALIAN; ENGLISH summary
(ISS-65/45) CFSTI: HC $2.00/MF $0.50

Action spectra of the effect of ultraviolet radiation on the physico-chemical properties of the DNA of phage α irradiated "in vitro" have been obtained. Using the analytical ultracentrifuge and the spectro-photometer the following effects have been studied: (a) production of interruptions in the single polinucleotide strand; (b) local denaturation; (c) presence of a fraction of molecules resistent to denaturation; (d) increase in the buoyant density of irradiated DNA. All of the action spectra thus obtained show a slight variation of the radiation efficiency in the range between 2600 and 2800 Å, and a well-defined peak at λ=2800 Å. Threshold values for all of the examined effects are 3000 Å. Author

N66-25789# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
STUDIES ON THE LOCALIZATION OF ASCORBIC ACID IN NORMAL AND NEOPLASTIC CELLS [STUDIO SULLA LOCALIZZAZIONE DELL'ACIDO ASCORBICO IN CELLULE NORMALI E NEOPLASTICHE]
A. Poletti and A. Violante 5 Oct. 1965 14 p refs
(ISS-65/32) CFSTI: HC $1.00/MF $0.50

An attempt has been made to set up a histochemical technique which could be used in the electron microscope to show the presence of vitamin C in the liver of the rat. Caulfield's fixative was used as the fixing liquid. Prefixing with aldehydes was omitted because it was not satisfactory. It was observed that for pieces of about 1 millimeter the time of prefixing which gave the best results was 10–15 minutes, that of treatment with nitrate of silver 10–20 minutes. The following were studied: (a) livers of normal rats, (b) livers of rats which had been given large amounts of ascorbic acid, and (c) livers of rats suffering from a transplanted leukemia. Author

N66-25811# Czechoslovak Academy of Sciences, Prague.
STUDY OF THE SYNTHESIS OF LIPIDS DURING POSTNATAL DEVELOPMENT OF RATS [SLOZENI A SYNTEZA LIPIDU V POSTNATALNIM VYVOJI U KRYS]
Milada Dobiasova 1966 81 p refs In CZECHOSLOVAKIAN; ENGLISH summary *Its* Vol. 76, No. 2

A biochemical study of the lipids during postnatal development of the rat is reported. The preparation of carbon 14 higher fatty acids and the determination of small quantities of lipids on a thin layer of silicagel by chromatographic techniques are described. The content and composition of lipids and their fatty acid content were determined in the liver, lung, small intestine, and brown adipose tissue. Active palmitate was used to study glyceride synthesis. Among the conclusions are: the esterified fatty acid content is lowered immediately after birth in all organs; the phospholipid content increases with age; the acid—phospholipid ratio is dependent on organ and age but not on diet; the triglyceride composition reflects the fatty acid spectrum of the food; palmitic acid is the main acid in the organs of the newborn rat, especially in the lungs; the incorporation of palmitate carbon 14 is highest on day 0, and is greatest in the lung; and active acetoacetic acid production is highest in the liver of 10-day old rats. N.E.N.

N66-25855# John B. Pierce Foundation of Connecticut, New Haven.
NEURONES AND TEMPERATURE REGULATION Final Report, Mar. 1963–Mar. 1965
H. T. Hammel Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 39 p refs
(Contract AF 33(657)-11103)
(AMRL-TR-65-232; AD-630462) CFSTI: HC $2.00/MF $0.50

An attempt was made to ascribe the regulation of body temperature in homeotherms to the hypothalamus and the preoptic region. Results of measurements of hypothalamic temperatures and regulatory responses in the normal dog in hot, neutral and cold environments and, at various times, in the resting, waking, sleeping, exercising and fevered state, are interpreted on the assumption that the hypothalamus responds to changes in its own temperature like a proportional controller with an adjustable set point. For each thermal regulatory response, the response was as if its magnitude were proportional to the deviation of the actual hypothalamic temperature from a set point temperature, and as if the set point temperature were to increase in the cold environment, decrease in the hot environment, decrease at the onset of sleep, decrease at the onset of exercise and increase in fever. A model based on known characteristics of neurones is proposed which appears to function like a proportional controller with an adjustable set point. Author (TAB)

N66-25933# Naval Aviation Safety Center, Norfolk, Va.
BODY-BUILD AND SURVIVAL IN EJECTIONS FROM NAVY AIRCRAFT
George T. Lodge [1965] 10 p refs Presented at the 73d Ann. Conv. of the Am. Psychological Assoc., Chicago, 7 Sep. 1965
(AD-630466) CFSTI: HC $1.10/MF $0.50

This study was conducted to determine between body-build and survival in ejections from Navy aircraft. A total of 1,148 ejectees had height/$\sqrt[3]{\text{weight}}$ ratios ranging from 11.72 to 14.06, with a median at 12.78. This distribution was divided into deciles and the proportions determined for each, of survivors to nonsurvivors. Fatalities ranged from a minimum of 6.1% in Decile IV to a maximum of 23.7% in Decile X. Pilots comprising Decile IV are of athletic build and have the most compatible dimensions for cockpits designed according to prevailing height–weight standards. Decile X consists of ectomorphs relatively maladapted to these cockpits, and more disadvantaged by g-stresses, etc., for emergency movements like pulling the face curtain. Author

N66-25992# Library of Congress, Washington, D. C. Science and Technology Div.
WORLD OUTLOOK FOR FOOD IRRADIATION
F. J. Weiss Washington, D. C., AEC, 15 Dec. 1965 15 p refs Presented at 24th Ann. Meeting of the Inst. of Food Technologists, Washington, May 1964
(WASH-1063; CONF-639-4) CFSTI: HC $1.00/MF $0.50

Developments in radiosterilization of food and their impact on the world food situation are discussed. NSA

N66-26041# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
PLUTONIUM URINALYSIS
N. Valentin, C. Weyers, and R. Boulenger Jul. 1965 23 p refs
(BLG-353)

A simple method of urinalysis, sensitive enough to detect 0.08 dpm of plutonium in 1500 ml of urine, is described. The method consists of a phosphate precipitation followed by the destruction of organic matters by ashing. Anion exchange is used to separate plutonium from other remaining inorganic ions and the final purified plutonium is deposited or electroplated on stainless steel discs and counted in a ZnS scintillator. Ten to twenty samples can be treated per day by two persons, the result being obtained three days after the beginning of the analysis. The recovery of about 3 dis./min of plutonium from a liter of urine is 78±4% with 95% confidence. Author (NSA)

N66-26053# Argentina. Comision Nacional de Energia Atomica, Buenos Aires.
DETERMINATION OF THE TOTAL BODY WATER BY MEANS OF TRITIUM WATER [DETERMINACION DEL AGUA TOTAL CORPORAL MEDIANTE EL AGUA TRITIADA]
Osualdo Degrossi, Maria A. Méndez, and Héctor Gotta 1965 19 p refs In SPANISH; ENGLISH summary
(CNEA-165) CFSTI: HC $1.00/MF $0.50

Tritium water has found increased use as a means of determining total body water volume. The authors have tried four different methods, finding that the most adequate for current laboratory practice is the *internal standards method*. Best time for extraction of samples was found to be four hours after radioactive tracer administration. Data obtained with samples of plasma and urine show no significant difference; either of them can be used. The results are in good agreement with those obtained by other authors. Total body water volume, as percentage of body weight, is equivalent in males and females, being less than average for overweight, and more than average for underweight individuals. It also shows a tendency to decrease with age. Author

N66-26162# Joint Publications Research Service, Washington, D. C.
ULTRAVIOLET RAYS FOR PROTECTION OF PLANTS
M. I. Zhigal'tseva and S. M. Chernobrovina *In its* Electron. Treat. of Mater. 2 May 1966 p 87–91 ref (See N66-26150 14-34) CFSTI: $4.00

This paper discusses the biological effects of ultraviolet radiation on insects, and its use in attracting and collecting insects to forecast and warn of impending insect invasions on crops and to obtain information on the biology of insect reproduction. R.N.A.

N66-26185# Stanford Research Inst., Menlo Park, Calif.
BIODYNAMIC CORRELATES Final Report, Jun. 1964–Dec. 1965
Samuel A. Ferguson Holloman AFB, N. Mex., 6571st Aeromed. Res. Lab., Feb. 1966 149 p refs
(Contract AF 29(600)-4657)
(ARL-TR-66-2; AD-478863)

An investigation of the injurious and lethal aspects of uniformly distributed applied overpressures were conducted with anesthetized cats submerged in a water chamber. The major site of injury following short (<10 msec) and moderately long (400 msec) duration overpressures was the central nervous system (CNS). Pulmonary pathology revealed the lungs were also involved. CNS deficits were indicated by overt behavioral and neurological disturbances (ataxia, prolonged unconsciousness) and CNS pathology. Pulmonary pathology was suggested by the presence of blood in the lungs, edema, and emphysema. Where feasible, the median effective level (EP-50) required to produce these effects was determined. A median lethal pressure level (LP-50) of 98 psig was calculated for short duration overpressure application to anesthetized submerged cats during peak exhalation. An analysis of the effects and distribution of applied overpressures on physiological parameters indicated high intracranial and intrathoracic pressures were produced. A correlation of these observations with pathological and behavioral data suggested that the cause of injury and death was primarily related to alterations in CNS activity. Pulmonary pathology, often noted by other investigators, also appeared to be associated with increases in intrathoracic pressure. Author (TAB)

N66-26227# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
RADIATION PASTEURIZATION OF FOODS; SUMMARIES OF ACCOMPLISHMENT
[1965] 211 p refs Presented at 5th Ann. Contractors Meeting, Washington, 20–21 Oct. 1965
(CONF-651024) CFSTI: HC $6.00/MF $1.25

Summaries of research efforts which were presented at the AEC's radiation pasteurization of foods program annual contractors meeting are given. The objective of this program is to extend the usable shelf life of both fresh and sometimes cooked food products through the use of ionizing radiation. Included are a current status and summary of each contract, summaries of five general sessions, and scopes of work of contracts in food preservation sponsored by the AEC. C.T.C.

N66-26233*# Maryland Univ., College Park. Dept. of Psychology.
REINFORCING VALUE OF INFORMATION Technical Report No. 65-1
Derek P. Hendry [1965] 27 p refs
(Grant NsG-189-61)
(NASA-CR-74906) CFSTI: HC $2.00/MF $0.50 CSCL 05J

A description is given of an experiment which was designed to show if information is reinforcing and if negative discriminative stimulus is both positively and negatively reinforcing. This was conducted relative to psychological work in which it is taken for granted that information about favorable or unfavorable states of the environment is reinforcing. That is, people will perform some task just to find out whether some other reinforcing event is likely to occur or likely not to occur. An adolescent female chimpanzee served in the experiment over a period of about 10 months. She had a previous history of reinforcement on ratio and multiple schedules. The chimp lived in the experimental space, which was a stainless steel, temperature controlled, air conditioned chamber. On one wall, 2 ft. above the floor, was a platform, above which was a 30 in. square aluminum work panel containing lights and levers. Water was continuously available, but the daily ration of food had to be obtained by working on the experiment 7 to 10 hrs. daily. Major conclusions are that while some of the results might be explained by traditional theories of conditioned reinforcement, the results as a whole could not be explained without considerable strain and the invention of several ad hoc principles. C.T.C.

N66-26235*# San Francisco Univ., Calif. Inst. of Chemical Biology.
BRAIN AMINO ACIDS AND BIOGENIC AMINES UNDER VARIOUS ATMOSPHERIC MIXTURES Semiannual Report, 1 Mar. 1965–30 Apr. 1966
Joseph H. Gast, H. B. Chermside, III, and M. A. Kelly 9 May 1966 37 p refs
(Grant NGR-05-029-001)
(NASA-CR-75080) CFSTI: HC $2.00/MF $0.50 CSCL 06A

Developments are presented in a study of the possible effects of exposure to different gaseous atmospheric mixtures for various periods of time upon the free amino acids and on the biogenic amines, especially serotonin (5-hydroxytryptamine), present in rat brains. Emphasis is placed on methodology, and includes brief discussions in experimental design, instrumentation, exposure and tissue preparation procedures, preliminary experimental results, and data analysis. C.T.C.

N66-26242*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
RADIATION GUIDELINES FOR MANNED SPACE VEHICLES—A REVIEW WITH RECOMMENDATIONS
A. A. Kelton Jul. 1965 118 p refs
(SM-47749)

A rationale, founded upon the philosophical acceptance of risk, was created for the evaluation, development, and application of radiation protection guidelines for manned space vehicles. The rationale was developed from the following: (1) a definition of the character of space radiation exposure, (2) the evaluation of pertinent, risk-limiting, radiobiological responses, and (3) the development of a philosophy of risk acceptance. Radiation risk was compared with the immediate and delayed risks to life from accepted socioeconomic pursuits. From this comparison, acceptable values for acute and late radiation risk were defined for manned space exploration. Within these criteria, current radiation protection guides were reviewed, and additional guidelines for radiation protection of astronauts were recommended. Author

N66-26260*# Kansas State Univ., Manhattan.
[GAS CHROMATOGRAPHY TECHNIQUES FOR THE DETERMINATION OF DILUTE CONSTITUENTS OF BIOLOGICAL MATERIAL, INCLUDING CONSIDERATION OF MATERIAL RELEVANT TO THE ECOLOGY OF ASTRONAUTS] Status Report, Oct. 6, 1965–Apr. 6, 1966
W. S. Ruliffson [1966] 27 p
(Grant NsG-292)
(NASA-CR-74972) CFSTI: HC $2.00/MF $0.50 CSCL 06A

Rat liver tissue was used either as a sucrose homogenate or as a mitochondrial suspension in an effort to establish mass spectrometer techniques for analyzing the dilute constituents of biological materials. The instrumentation for the experiments is described in detail; and data are presented in tabular and graphic form. The results show: (1) that the mass spectrometer is a useful tool for detecting and characterizing small amounts of material evolved by a normal respiring suspension; (2) that the breakdown of methionine by mitochondria, producing $H_3C—S—CH_3$ and $H_3C—S—S—CH_3$, is uncommon; and (3) that aged mitochondria produce M/e 60 (possibly acetic acid), as well as Me (acetone) in greater amounts than that produced by normal fresh mitochondrial. Further, while the data did not establish the importance of ethylene evolution from respiring tissue, it was suggested that C_2H_4 evolution is a general property of life and that ultraviolet radiation may convert C_2H_4 into ethylene oxide or other mutogenic derivatives in vivo. D.T.

N66-26263*# IIT Research Inst., Chicago, Ill.
LIFE IN EXTRATERRESTRIAL ENVIRONMENTS Quarterly Status Report, Feb. 15–May 15, 1966
Charles A. Hagen [1966] 24 p
(Contract NASr-22)
(NASA-CR-74969; IITRI-L6023-5) CFSTI: HC $1.00/MF $0.50 CSCL 06F

Martian environment simulation experiments to study the effects of barometric pressures, carbon dioxide concentrations, and desert soils on Bacillus cereus spores are reported. These included: earth atmosphere at pressures of 10–98 mb; and carbon dioxide concentrations of 37–100% at pressures of 10–98 mb. Spore germination was inhibited by carbon dioxide at all concentrations and pressures. Germination was not inhibited at 10 mb with earth atmosphere, but vegetative cell growth was less than at 98 mb. Graphs are presented showing these effects. Soil ecology experiments to determine the minimum numbers of a bacterium required to survive and grow in different soil types are described. Inhibition of B. cereus spore germination in pulverized felsite/limonite mixture was detected. The spores did not germinate in mixtures of pH 8–8.4, but did germinate in soil of pH 7. Low numbers of P. aeruginosa and S. aureus did not survive 7 days in a desert soil environment with 99% relative humidity at 1013 mb. N.E.N.

N66-26290# Air Force Systems Command, Kirtland AFB, N. Mex. Weapons Lab.
MEDIAN LETHAL DOSE (LD-50/60) STUDIES IN SHEEP FOLLOWING 250 kvp X-IRRADIATION
Thomas S. Mobley, William R. Godden, and Jelle de Boer Mar. 1966 29 p refs
(AFWEL-TR-65-200; AD-631189) CFSTI: HC $2.60/MF $0.50

Seventy-four sheep, Ovis aries, were subjected to bilateral, total-body, 250-kvp X-irradiation at a dose rate of 7.5 r/min. Doses ranging from 218 to 518 r (midline air dose) were administered at nine different dose levels. Probit analysis of the mortality data revealed a 50-percent, 60-day (LD-50/60) lethal dose value of 389 r with 95-percent confidence limits of from 334 r to 437 r. Converting midline air dose to midline tissue does resulted in the value 245 r with limits of from 210 r to 275 r. All deaths occurred between 16 and 32 days following irradiation. Hematological studies and gross necropsies confirmed the severe involvement of the hematologic system. Author (TAB)

N66-26291# Rutgers Univ., New Brunswick, N. J. Dept. of Physiology and Biochemistry.

CARDIOVASCULAR RESPONSES OF DIVING AND NON-DIVING MAMMALS TO APNEA

F. L. Ferrante and H. M. Frankel Brooks AFB, Tex., School of Aerospace Med., Feb. 1966 16 p refs

(Contract AF 41(609)-2635)

(SAM-TR-66-17; AD-631139) CFSTI: HC $1.60/MF $0.50

Heart rate, arterial and right atrial blood pressure, and cardiac output were monitored continuously before and during periods of apnea in anesthetized nutria and cats. In the nutria, arterial blood pressure was maintained at an average of 182 seconds after profound bradycardia developed despite a decreased cardiac output. In cats arterial blood pressure began to decrease at 81±5.5 seconds, an average of 51 seconds before profound bradycardia was observed. The increase in peripheral resistance during apnea in cats was less than 20% of that found in nutria. Evidence of cardiac failure was found before bradycardia in the cat, but not in the nutria. It was concluded cardiovascular responses reported for diving mammals could be initiated by hypoxia and hypercapnia independent of intrathoracic pressure changes and the response of receptors in the nares sensitive to water. Author (TAB)

N66-26305# Oregon State Univ., Corvallis. Radiation Center.

EXPOSURES OF BIOLOGICAL SYSTEMS TO INORGANIC FLUORIDE OXIDIZING AGENTS. VOLUME II: FLUORIDE ANALYSIS BY CHEMICAL METHODS Final Report, 1 Jul. 1964-30 Jun. 1965

Donald J. Reed, Frank N. Dost, and Chih H. Wang Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 27 p refs

(Contract AF 33(615)-1799)

(AMRL-TR-65-223, Vol. II; AD-630593) CFSTI: HC $2.00/MF $0.50

Methods are described for assaying the fluoride content of ashed samples of plant and animal tissues. Using the Hall method, submicrogram quantities of fluoride were measured and a new procedure was devised to measure fluoride in a 1 to 8 microgram range. Modification of the Weinstin procedure, in which an Auto Analyzer is used, permitted rapid and semiautomated analysis of samples containing 2.5 to 100 micrograms of fluoride. Author (TAB)

N66-26307# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PROBLEMS OF BIOLOGY OF SPACE FLIGHT. THE IDEAS OF TSIOLKOVSKI BECOME REALIZED

V. B. Malkin 24 May 1965 24 p refs Transl. into ENGLISH from Priroda (Moscow), no. 10, 1959 p 35-44

(FTD-TT-65-73/1+2; AD-618644)

This paper discusses some of the experimental work of the Russian scientist K. E. Tsiolkovski in the area of space biology. His experiments on the effects of acceleration, water submersion protection against acceleration shock, and the effects of weightlessness are described. His proposals for life support systems, space cabin air regeneration, spacecraft temperature control, and space suits are also discussed.

R.N.A.

N66-26356# Lankenau Hospital, Philadelphia, Pa.

EFFECT OF EXERCISE, STANDING, NEGATIVE TRUNK AND POSITIVE SKELETAL PRESSURE ON BED REST-INDUCED ORTHOSTASIS AND HYPERCALCIURIA Final Report, Feb. 1964-Jan. 1965

N. C. Birkhead, J. J. Blizzard, B. Issekutz, Jr., and K. Rodahl Wright-Patterson AFB, Ohio, AMRL, Jan. 1966 36 p refs

(Contract AF 33(615)-1538)

(AMRL-TR-66-6; AD-630921) CFSTI: HC $2.00/MF $0.50

Tilt intolerance and hypercalciuria were induced in healthy subjects fed weighed diets by 18-32 days continuous bed rest in a Metabolic Ward. The effect of supplementing bed rest with daily supine bicycle exercise (2 or 4 hours), quiet standing (3 hours), or longitudinal supine skeletal pressure on orthostasis and urinary calcium was determined. Tilt tolerance was evaluated by blood pressure and heart rate response to 10 minutes of 70° head-up body tilt and urinary calcium excretion by analysis of 3- or 6-day urine collections. Supine bicycle exercise was ineffective in significantly reducing tilt intolerance or hypercalciuria. Standing decreased orthostasis in 3 of 5 subjects and decreased urinary calcium in 4 of 5 subjects. Longitudinal skeletal pressure decreased hypercalciuria in 1 of 2 subjects but did not improve tilt tolerance. Intermittent lower body negative pressure during bed rest in one subject impeded development of orthostasis but increased urine calcium. Three hours daily standing is the minimum effective duration for reversing bed rest-induced tilt intolerance and hypercalciuria while supine bicycle exercise is not a practical method for obtaining similar effects. Author (TAB)

N66-26434# Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N. Mex.

AN INVESTIGATION OF THE RELATIONSHIP BETWEEN EXPERIENCE PARAMETERS AND SUBJECT ACCELERATION RESPONSE IN EXPERIMENTAL IMPACT

Peter Foster Mar. 1966 24 p refs

(ARL-TR-66-8; AD-630788) CFSTI: HC $2.60/MF $0.50

Studies of human test subjects undergoing sustained acceleration on the centrifuge have shown that tolerance increases with experience. This fact suggested the need for an investigation to determine if a similar relationship existed between certain impact experience parameters and subject acceleration response, which was used as an indicator of subject tolerance to impact exposure. A number of human test subjects having varying degrees of experience with experimental impact acceleration were exposed to identical impact profiles. Correlations of experience factors to indicated tolerance showed no significant relationship.

Author (TAB)

N66-26462# New York Univ., N. Y. Inst. of Environmental Medicine.

STATISTICAL ANALYSIS OF ENVIRONMENTAL AND TOTAL BODY GAMMA-RAY SCINTILLATION SPECTRA Annual Progress Report, Oct. 1964-Sep. 1965

Bernard Pasternack and Anthony Liuzzi 30 Sep. 1965 157 p refs
(Contract AT(30-1)-3136)
(NYO-3136-2) CFSTI: HC $5.00/MF $1.00

The statistical analysis of pulse-height distribution data from γ scintillation counting is discussed. Emphasis is placed on the concept of model adequacy, the development of procedures for detecting inappropriate or inadequate models, and the statistical properties of the estimates derived from the calculational procedures. The results of an empirical sampling study designed to investigate the use of overall model confirmed the validity of the method of analysis. A procedure is described that was developed for calculations of instrument gain and baseline discrepancy compensation. Appendixes I through IV contain an IBM 7094 Fortran program, PARANA, for the pulse-height analysis of radionuclide assay; a test for regression model adequacy in radionuclide assay; results of an empirical sampling study to evaluate the suitability of a statistical model used in analyzing the pulse-height distributions arising from the scintillation counting of radioactive materials; and a statistical study of probability of failure of an idealized light bulb while in use. NSA

N66-26490# Aerospace Medical Div. Arctic Aeromedical Lab., Fort Wainwright, Alaska.
HEART RATE OF BLACK BEARS IN RELATION TO AGE Technical Report, 6 Jan.–1 Sep. 1965
Raymond J. Hock Jan. 1966 10 p refs
(AAL-TR-65-20; AD-630133) CFSTI: HC $1.10/MF $0.50

Records were made of heart rates of 4 black bears, 2 males and 2 females, ages 1 to 42 months, weighing 0.6–70 kg. In the large bears, succinylcholine chloride was administered intramuscularly. The cubs were held while syringe needles connected to an EKG machine were inserted subcutaneously. It appears there is a marked fall in heart rate in black bears with increasing age until adulthood is reached. Succinylcholine vs. handling without anesthetic does not appear to be a factor in the results. Rates seem high, especially those of the larger, older bears. Though rectal temperature was normal, the excitement incident to anesthetic injection and the convulsive nautre of its onset of action must be considered as factors in elevation of heart rate. Thus it seems possible that heart rates of the young bears are more reliable and that decrease in heart rate with age is even more marked than shown.
Author (TAB)

N66-26502# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIATION SAFETY
Yu. Grigor'yev and Ye. Kovalev 1 Feb. 1966 11 p Transl. into ENGLISH from Med. Gazeta (USSR), 21 Sep. 1965 p 3 (FTD-TT-65-1682/1+4; AD-629422) CFSTI: HC $1.60/MF $0.50

A narrative review of the problems encountered in radiation shielding of spacecrafts and for space walks is presented. The nature and composition of galactic cosmic radiation, solar radiation, and the inner and outer radiation belts about the earth are indicated. It is pointed out that the most important source of radiation danger is the corpuscular radiation from chromospheric flares on the sun. The protective measures taken for the Voskhod II space walk are mentioned. Investigations on radiation sickness, biological response to radiation, and pharmacological protection are reviewed. N.E.N.

N66-26507# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
PHYSIOLOGICAL STATUS OF MEN SUBJECTED TO PROLONGED CONFINEMENT Final Report, Feb. 1963–Feb. 1965
E. W. Speckmann, K. J. Smith, K. M. Offner, and J. L. Day (NASA, Manned Spacecraft Center, Houston, Tex.) Dec. 1965 19 p refs Prepared in cooperation with NASA Presented at the Federation Meeting of the Am. Physiological Soc., Atlantic City, 13 Apr. 1965
(NASA Order R-85)
(AMRL-TR-65-141; AD-630114) CFSTI: HC $1.00/MF $0.50

To determine if confinement of men resulted in physiological changes, 12 men in groups of 4 each were confined for 28 consecutive days. During this time, daily measurements of ECG, EEG, blood pressure, respiration, and oral temperature were made. Oxygen consumption and carbon dioxide production were measured daily on four subjects for 6 days before and for 6 days following confinement as well as three times weekly during confinement. With eight subjects, the same measurements were made before, during, and following exercise on a bicycle ergometer at a rate causing the subject to expend an average of 70 additional kcal per hour above resting values. The same metabolic measurements were made on four subjects 2.5 hours postprandial. The metabolic responses to confinement as well as exercise during confinement were measured. In general, there were no significant measured physiological changes from pretest control values resulting from prolonged confinement. Author (TAB)

N66-26508# Bryn Mawr Coll., Pa. Dept. of Biology.
STUDIES ON MECHANISMS OF TRYPTOPHAN PYRROLASE INHIBITION DURING ENDOTOXIN POISONING Technical Report, 1 Dec. 1964–28 Feb. 1965
George N. Eaves and L. Joe Berry Ft. Wainwright, Alaska, Arctic Aeromed. Lab., Jan. 1966 24 p refs
(Contract AF 41(609)-1764)
(AAL-TR-65-14; AD-630134) CFSTI: HC $1.00/MF $0.50

The inhibition of tryptophan pyrrolase in vitro by plasma and certain other native substances was investigated in an attempt to elucidate mechanisms responsible for the assumed decrease in activity of this enzyme in vivo during endotoxin poisoning. The inhibitor in plasma was present in normal mice, but increased significantly in endotoxin-poisoned, cortisone-protected, tolerant and challenged tolerant mice. On the basis of its physical properties and kinetics of inhibition, the plasma inhibitor was identified circumstantially as a globin. Results of kinetic studies eliminated the plasma inhibitor as a causal factor in the irreversible decrease in activity of tryptophan pyrrolase in whole homogenates of liver from endotoxin-poisoned mice. The enzyme was also found to be inhibited by citrate, the concentration of which increases substantially in the liver during endotoxicosis. Since inhibition by citrate could not be reversed by excess cofactor or substrate, it was concluded that at least part of the decreased activity of tryptophan pyrrolase in whole homogenates of poisoned mice was the result of inhibition by citrate. Author (TAB)

N66-26511# Naval Radiological Defense Lab., San Francisco, Calif.
RESPONSES OF SINGLE NEURONS IN THE OLFACTORY BULBS OF RABBITS, DOGS, AND CATS TO X-RAYS
Gary P. Cooper, Donald J. Kimeldorf 26 Jan. 1966 15 p refs
(USNRDL-TR-969; AD-630323) CFSTI: HC $1.60/MF $0.50

Extracellular microelectrode recordings were made of the activity of single neurons in the olfactory bulbs of anesthetized cats, rabbits, and dogs. In all three species, brief exposure

to X-rays (250 KVP; exposure rate, 1 R per second) produced an alteration in firing rate in some olfactory bulb neurons. The response to irradiation was usually an increase in firing rate, but in a few cases a depression in firing rate was observed. Author (TAB)

N66-26529# Electronic Systems Div., Bedford, Mass. Decision Sciences Lab.
HUMAN DIFFERENTIAL SENSITIVITY TO VIBROTACTILE STIMULATION USING A PASSIVE ENVIRONMENTAL SENSOR
John Coules and Donald L. Avery Nov. 1965 31 p refs
(ESD-TR-65-576; AD-627239) CFSTI: HC $2.00/MF $0.50

A passive environmental sensor was evaluated as an input device capable of presenting tactile data to a human. The experiment provided information on the ability of the human to detect differences within the range of the vibratory transducer. Frequency discrimination thresholds showed wide differences between subjects and a significant increase in human sensitivity at one point of the frequency input levels. This increased sensitivity was explained in terms of the resonant frequency of the vibratory and also in terms of the generally known high human sensitivity for amplitude and frequency changes at 200–300 cps. It was concluded that for fine-grain data discrimination individual differences may influence the final design of the sensor. However, these differences may be reduced and the sensitivity of the user improved if its electronic design and its transducers provide redundancy to the human.
Author (TAB)

N66-26531# Ohio State Univ. Research Foundation, Columbus.
VISUAL RECOVERY FROM HIGH INTENSITY FLASHES Interim Report, 15 May 1964–15 May 1965
Norma D. Miller Brooks AFB, Tex., School of Aerospace Med., Jul. 1965 90 p refs
(Contract AF 41(609)-2426)
(ITR-1; AD-627325) CFSTI: HC $3.00/MF $0.75

High intensity flashes of 0.04 msec to 1.4 msec duration were used to determine the afterimage brightness as a function of time following the flash. Six human subjects made continuous matches of the afterimage for periods up to six minutes following the flashes. The flash energies ranged from 3×10^{-7} to 800,000 td.sec or from 0.012 to 0.0003 cal/cm sq. at the retina, neglecting losses in the ocular media. The mean afterimage brightness, 5 sec following the highest intensity flashes, was 100,000 td. The afterimage brightness data were correlated with recovery time measurements for Sloan–Snellen letters presented at luminance levels from 280 mL to 0.07 mL. The reciprocity relationship between the duration and luminance of flashes subtending 7.5 degrees visual angle was investigated for constant flash energy of 3×10^{-7} td.sec. Seven flash durations from 0.5 to 5.0 msec were tested. The recovery times for the Sloan–Snellen letters at various luminance levels increased approximately 30% following 1.5 msec flashes compared with the 0.5 msec flashes. There was no apparent change for the mean recovery times for four subjects following flashes from 1.5 msec in duration.
Author (TAB)

N66-26556# Duke Univ., Durham, N. C. Medical Center.
INFLUENCE OF ARTERIAL OXYGEN TENSION ON APNEIC THRESHOLD FOR CARBON DIOXIDE IN NORMOTHERMIC AND HYPOTHERMIC DOGS Final Report, Nov. 1962–Nov. 1964
J. V. Salzano and F. G. Hall Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 14 p refs
(Contract AF 33(657)-10279)
(AMRL-TR-65-211; AD-629870) CFSTI: HC $1.00/MF $0.50

Anesthetized dogs were hyperventilated with various CO_2-free gas mixtures containing 6-100% O_2 at a rate of 16 l/min. for 4 minutes at normal and reduced body temperatures (28°C). Arterial blood samples were withdrawn at the start of the first breath following the apneic period and analyzed for PCO_2, PO_2, and pH. The $PaCO_2$ was used as an index of the respiratory threshold for PCO_2 and designated as $PTCO_2$. At both normal and reduced body temperatures the $PTCO_2$ decreased when the PaO_2 was lowered as a result of hyperventilation with a low oxygen gas mixture. The $PTCO_2$ was highest when the PaO_2 was highest following hyperventilation with 100% O_2. The relationship between PaO_2 and $PTCO_2$ was alinear at both temperatures. During normothermia the slope of a plot of the mean values of the $PTCO_2$-PaO_2 relationship was steepest below a PaO_2 of 35 mm Hg and in hypothermia the relationship was steepest below approximately 20 mm Hg PaO_2. The results indicated no real apneic threshold for $PaCO_2$ during normothermia or hypothermia but rather one which directly is related to the PaO_2. Author (TAB)

N66-26568# Applied Science Associates, Inc., Valencia, Pa.
EFFECT OF FORMAT AND DETAIL OF JOB PERFORMANCE AIDS IN PERFORMING SIMULATED TROUBLE-SHOOTING TASKS Final Report, Nov. 1963–Nov. 1964
Thomas K. Elliott Wright-Patterson AFB, Ohio, AMRL, Nov. 1965 52 p refs
(Contract AF 33(615)-1137)
(AMRL-TR-65-154; AD-629992) CFSTI: HC $3.00/MF $0.50

The effects of performance aid format, performance aid detail, and subject aptitude on the performance of paper and pencil data flow analysis tasks were measured. Sixteen subjects were used in a 2×2×2 design. Eight of these subjects scored between the 75th and 95th percentiles on the electronic aptitude index of the Airman Qualifying Exam, the other eight, between the 40th and 60th percentiles. Each subject received approximately 30 hours of training and practice, following which he was tested at one of the two levels of detail. Each subject was tested for 9 hours with aids in the block diagram format and for 9 hours with aids in the list structure format. Order of testing was counterbalanced across subjects. Criterion measures were: (1) number of problems attempted; (2) percentage of errorless localizations; (3) number of localization errors per problem; (4) number of localization errors of exclusion per problem, and; (5) percentage of errorless isolations. Subject aptitude was found to have the greatest effect on the accuracy with which subjects performed both localization and isolation tasks. Level of detail had the greatest effect on their speed (low level of detail subjects solved nearly twice as many problems as high level of detail subjects). Performance was better with the diagrams than with the list structures. Author (TAB)

N66-26583# Industrial Biology Research and Testing Labs., Inc., Philadelphia, Pa.
CUTANEOUS TOXICITY EVALUATION OF AIR FORCE DEVELOPMENT MATERIALS, VIII Final Report, Jun.–Oct. 1965
Morris V. Shelanski Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 12 p refs
(Contract AF 33(615)-1571)
(AMRL-TR-65-208; AD-629764) CFSTI: HC $1.00/MF $0.50

Four Air Force development materials were studied via the prophetic patch test method on laboratory animals to determine the primary irritant effect, gross sensitization index, and gross percutaneous toxicity of these materials. The patch test studies with rabbits indicated that one of the materials produced severe primary irritant action. Testing on human volunteers was therefore carried out with three of the materials. Results indicated that these materials were safe to use in contact with human skin. Author (TAB)

N66-26587# Colorado State Univ. Research Foundation, Fort Collins.

A STUDY OF PITUITARY, THYROID AND ADRENAL GLAND RELATIONSHIPS IN GROUND SQUIRRELS (*CITELLUS RICHARDSONI*) AS INFLUENCED BY DIET AND ATMOSPHERIC PRESSURE Final Report

R. R. Lechleitner 10 Dec. 1964 26 p refs

(Contract Nonr-1610 (07))

(AD-609414) CFSTI: HC $1.00/MF $0.50

The objectives of the research were (a) to study the dietary changes occurring in ground squirrels prior to their entrance into hibernation; (b) to determine if a correlation exists between dietary changes and functional activity of the pituitary, thyroid and adrenal cortex, and (c) to study the time relationship of changes in functional activity of these glands. The work accomplished under this contract involved three phases and the results are presented separately for each phase. Phase One consisted of a field investigation of the squirrels under natural conditions near Tie Siding, Wyoming. Phase Two consisted of laboratory studies of circulating pituitary (ACTH, TSH) and thyroid hormones. Phase Three consisted of a laboratory experiment designed to test the efficacy of various diets upon activity patterns, weight gains, endocrine activity, and the hibernating ability of the squirrels. TAB

N66-26598# Naval Radiological Defense Lab., San Francisco, Calif.

EFFECTS OF TOTAL-BODY X-IRRADIATION ON PERITONEAL AND CIRCULATING LEUCOCYTES OF MICE

Lottie Kornfeld and Vivian Greenman 13 Jan. 1966 26 p refs

(USNRDL-TR-966; AD-630103) CFSTI: HC $2.60/MF $0.50

Total-body X-irradiation over a wide range of doses was found to alter the number and distribution of cells in the peritoneal cavity of unstimulated LAF-1 mice. Unirradiated controls yielded $5–7 \times 10^6$ mononuclear cells, about 30% of which were macrophages and 70% small and medium lymphocytes. Following exposure to sublethal X-ray doses (90–590 R), macrophage counts were essentially unaltered for two weeks but declined slightly during the 3rd week after 390–590 R. Following a midlethal dose (690 R), the number of macrophages was unchanged for one week but fell to about 50% of the normal value by 21 days postirradiation. After lethal irradiation (790–1190 R), macrophage counts remained unaltered for 3 days but decreased on the 7th day. The number of lymphocytes in the peritoneal cavity decreased sharply within 24 hours after every dose employed and then declined further at a more gradual rate. Both the initial and the subsequent disappearance of lymphocytes increased in severity with increasing exposure. During the first week postirradiation, a linear relation existed between the percentage of lymphocytes in the peritoneal cell population and the X-ray dose. Author (TAB)

N66-26648*# Oregon State Univ., Corvallis. Dept. of Microbiology.

SYSTEMATIC DESCRIPTION OF BACTERIAL ISOLANTS FROM RIGOROUS ENVIRONMENTS. DESCRIPTIVE CHARTS OF SAHARA DESERT ISOLANTS

W. B. Bollen 1 Apr. 1966 47 p Prepared for JPL

(Contracts NAS7-100; JPL-950783)

(NASA-CR-75107) CFSTI: HC $2.00/MF $0.50 CSCL 06M

Descriptive charts are presented for 19 bacterial isolants from the Sahara Desert. It is pointed out that the results are pending clarification of anomalous reactions. The isolants were identified and broken down into the following groups: (1) Bacillus subtilis; (2) Bacillus megaterium; and (3) Brevibacterium. Two others, not yet identified, are characterized as pleomorphic, appearing generally as cocoid rods; the affinities are uncertain. D.T.

N66-26651*# Naval School of Aviation Medicine, Pensacola, Fla. Naval Aerospace Medical Inst.

MODIFICATION OF VESTIBULAR RESPONSES AS A FUNCTION OF RATE OF ROTATION ABOUT AN EARTH-HORIZONTAL AXIS

Manning J. Correia and Fred E. Guedry, Jr. Mar. 1966 21 p refs

(NASA Order R-93)

(NASA-CR-75112; NAMI-957) CFSTI: HC $1.00/MF $0.50 CSCL 06S

Eight men completed an experiment in which they were rotated about an Earth-horizontal axis at velocities of 10 and 30 RPM. Both nystagmus and subjective estimates of body position in space were modified by the higher rate of rotation. Subjects who gave essentially veridical estimates of body position at 10 RPM became disoriented at 30 RPM and gave responses closely resembling those of subjects with labyrinthine dysfunction. Subjects who produced sustained unidirectional horizontal nystagmus during constant velocity rotation at 10 RPM produced a reversing horizontal nystagmus during comparable intervals of rotation at 30 RPM. Nystagmus slow phase velocity for both 10 and 30 RPM exhibited a cyclic modulation which was related to orientation relative to gravity. As in previous studies, sickness was produced by rotation about a horizontal axis, and a relationship between mental task and incidence of sickness was again noted. Author

N66-26657*# Oregon State Univ., Corvallis.

MICROORGANISM STUDY Progress Report

W. B. Bollen 9 Apr. 1965 68 p Prepared for JPL

(Contracts NAS7-100; JPL-950783)

(NASA-CR-75123) CFSTI: HC $3.00/MF $0.75 CSCL 06M

Descriptive charts are presented for 19 Bacillus cultures of isolants from the Sahara Desert, along with a detailed characterization of the colony. The morphology descriptions are supplemented with photomicrographs of nigrosin, Gram, and Flagella stains. Information is also given on ages, temperature, and media. D.T.

N66-26688*# New England Medical Center Hospitals, Boston, Mass.

BIOMAGNETISM AND FERRITIN Semiannual Report

Peter W. Neurath and Ellen G. Sloane 12 May 1966 21 p

(Grant NGR-22-021-002)

(NASA-CR-75181) CFSTI: HC $2.00/MF $0.50 CSCL 06S

The initial considerations in establishing procedures for investigating the influence of a magnetic field on the development of frogs' eggs and frog embryos are summarized. Fertilization and growth procedures are discussed and methods

for obtaining histological and cytological sections of developing eggs and embryos are described. Photographs of the specimen obtained are included. H.S.W.

N66-26720# Naval Ordnance Lab., White Oak, Md.
SYNTHETIC NERVE NETWORKS Final Report
Alfred J. Cote, Jr. 27 Apr. 1965 141 p refs
(NOLTR-65-55; AD-625225) CFSTI: HC $4.00/MF $1.00

Most models of pattern recognition processes are conceived without regard to the difficulties which might be anticipated if one had to fabricate a full scale engineering model embodying the proposed principles. This report discusses recognition systems which take into account the fabrication limitations one would expect to encounter in the construction of extremely high density microelectronic pattern recognition systems. The resulting analog systems respond to transient patterns and the various artificial neurons within them exhibit functional behavior comparable to that found in biological prototypes. The application of these principles is first discussed in terms of a visual processing system which would exhibit many of the properties attributed to nerve fibers in the visual systems of frogs and cats, including those line sensing properties attributed by Hubel to fibres in the cat's visual cortex. The manner in which these same principles can be applied to the problem of sound recognition is then considered. Methods of realization, and an important function of learning in such systems, are also discussed. Author (TAB)

N66-26750*# Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N. Mex.
THE REFRACTIVE CHARACTERISTICS AND INTRAOCULAR TENSIONS OF COLONY CHIMPANZEES Technical Report, Aug. 1965
Donald N. Farrer and Francis A. Young Nov. 1965 17 p refs
(NASA Order R-35)
(NASA-CR-75169; ARL-TR-65-23) CFSTI: HC $1.00/MF $0.50 CSCL 06C

Ninety-six chimpanzees, 54 males and 42 females, ranging in age from less than 3 years to 15 years, were refracted in both supine and sitting positions under Sernylan anesthesia and Cyclogyl cycloplegia. Intraocular pressures were obtained under the same conditions. High reliability ($r=+.930$ overall) between refractions and the tendency toward increasing minus refractive error as a function of age was confirmed. Author

N66-26828*# Dartmouth Coll., Hanover, N. H. Dept. of Biological Sciences.
THE EFFECT OF WEIGHTLESSNESS ON THE GROWTH AND ORIENTATION OF ROOTS AND SHOOTS OF MONOCOTYLEDNOUS SEEDLINGS Final Report, 1 Jul. 1964–30 Jun. 1965
Charles J. Lyon 30 Jul. 1965 46 p refs
(Contract NAS2-1558)
(NASA-CR-75092) CFSTI: HC $2.00/MF $0.50 CSCL 06C

An effective method and working models of apparatus have been developed for a 3-day biosatellite experiment to grow wheat seedlings in special seed holders which permit growth of both roots and coleoptile in moist air. A photographic record of the seedlings at the end of the period provides for measurement of orientation angles of the organs. Measurements from tests in preprototype hardware rotating on a horizontal clinostat to simulate the condition of zero gravity by eliminating the tropistic effects of gravity, show characteristic curvatures in 3 dimensions for all organs. These deviations from the growth form of seedlings grown erect to gravity suggest that similar curvatures and other irregularities in orientation may be found in seedlings grown with zero effects of gravity and recovered from the orbital experiment. Author

N66-26840# AiResearch Mfg. Co., Los Angeles, Calif. Dept. of Life Sciences.
REDUCED BAROMETRIC PRESSURE AND RESPIRATORY WATER LOSS, 1 APRIL–31 OCTOBER 1964
Edward C. Wortz, Robert A. Diaz, Frederick H. Green, Warren G. Sanborn, David K. Edwards, III et al Brooks AFB, Tex., School of Aerospace Med., Feb. 1966 81 p refs
(Contract AF 41(609)-2389)
(SAM-TR-66-4; AD-631151) CFSTI: HC $3.00/MF $0.75

Respiratory water loss was investigated with a group of normal subjects breathing oxygen orally. Data were collected from all subjects under three absolute pressures (3.5, 7.0, and 14.7 p.s.i.), three work rates on a treadmill (0, 2, and 4 m.p.h.), three humidities of the inspired oxygen (40°F, 60°F, and 80°F dewpoint), and three drybulb temperatures of the inspired oxygen (95°F, 75°F, and 55°F). The data were analyzed statistically. All of these variables affected respiratory water loss in varying degrees. Reduced pressure diminished respiratory water loss, apparently because of a corresponding decrease in minute volume observed at lower pressures. Increased work rates elevated pulmonary ventilation and thus increased respiratory water loss. Increasing humidity decreased water loss, while increasing drybulb temperature produced greater water loss. Expired gas temperatures approached body temperature only at elevated inspired temperature; the expired gas volume was never saturated. Author (TAB)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N66-25580*# Spacelabs, Inc., Van Nuys, Calif.
X-15 DATA DISPLAY SYSTEM
Washington, NASA, May 1966 83 p
(Contract NAS4-589)
(NASA-CR-460) CFSTI: HC $5.00/MF $0.75 CSCL 06B

Advanced signal processing techniques for the data display system were studied. The general procedure was conversion of flight data (physiological and environmental parameters of interest to the medical monitor) to digital form, the digital process programming, testing and debugging, and interpretation of application run results. Details are given on the electrocardiogram (ECG), autocorrelation, ECG digital filtering, spectral ECG analysis, digital synthetic ECG waveform generation, ECG waveform averaging, respiration signal processing, and Korotkow sound signal processing. Certain trouble areas such as waveform distortion, unreliable performance of bandpass filtering, and waveform averaging difficulties are discussed. It was felt that the techniques have not received sufficient reliability or economy to warrant implementation into an operational system. Areas of work needing further study are indicated. N.E.N.

N66-25565*# CBS Labs., Stamford, Conn.
DEVELOPMENT OF AN ELECTRONIC DUMMY FOR ACOUSTICAL TESTING (INCORPORATING MANUAL OF OPERATION AND DESIGN) Final Report, Jun. 1965–Feb. 1966
28 Mar. 1966 93 p
(Contract NAS9-4414)
(NASA-CR-65348; CLD-1760) CFSTI: HC $3.00/MF $0.75 CSCL 06B

The electronic dummy provides an exact replica of an average male torso from the xiphoid process upward, including the simulation of natural flesh impedances, an artificial voice, and a highly advanced artificial ear. The fabrication methods are summarized, and the details of the construction, testing, and characteristics of the aural and voice simulators are reviewed. An instruction manual for operation and maintenance is included. The theory of operation and the operational processes are discussed, and a typical measuring procedure is outlined. The test equipment and the methods for calibrating and aligning the components are designated. Instructions are given for disassembly and reassembly.
N.E.N.

N66-25581*# LTV Aerospace Corp., Dallas, Tex. Astronautics Div.
UNMANNED EXTRAVEHICULAR ENVIRONMENTS OPERATION QUALIFICATION TEST OF THE GEMINI EXTRAVEHICULAR SUPPORT PACKAGE AND EXTENDED UMBILICAL Test Plan
B. W. Tyler 24 Nov. 1965 58 p refs *Its* Rept.-00.724
(Contract NAS9-3414)
(NASA-CR-65357) CFSTI: HC $3.00/MF $0.50 CSCL 06K

The test plan is presented which describes the unmanned portion of the extravehicular environments operation qualification test program for the Gemini extravehicular support package (ESP) and the extended umbilical. The test program is designed to qualify the ESP and extended umbilical for proper operation in the space environment, and includes two unmanned tests of the ESP during simulated Gemini near earth day and night orbital conditions. The ESP will be attached to a thermal dummy wearing a Gemini extravehicular suit assembly. During pump down and stabilization, the suit and extended umbilical are to be controlled with infrared lamps and the earth thermal. Depletion of the ESP oxygen bottle is to be accomplished by venting the oxygen outside the chamber through a flowmeter and an adjustable control valve. The temperature, pressure, and solar radiation parameters of the simulated conditions are given, and the data processing and check lists are included.
N.E.N.

N66-25582*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
MSC AIR EVAPORATION WATER RECLAMATION SYSTEM. Final Report
H. Kolnsberg 11 Aug. 1965 69 p refs
(Contract NAS9-3796)
(NASA-CR-65345) CFSTI: HC $3.00/MF $0.75 CSCL 06K

An automatic air evaporation processing system for the reclamation of potable water from urine was designed and constructed. System operation and performance in both preliminary and acceptance testing are discussed. The test results show that the product water possesses no objectionable color, odor, or taste and contains only trace impurities well below the limits established by the United States Public Health Service for drinking water. It is noted that while the system has been designed for zero gravity operation, the evaporating wick remains gravity dependent and will not necessarily perform properly in all attitudes in a gravity field; all other components, however, are gravity independent.
D.T.

N66-25685# George Washington Univ., Washington, D. C. Human Resources Research Office.
CHANGES IN FLIGHT TRAINEE PERFORMANCE FOLLOWING SYNTHETIC HELICOPTER FLIGHT TRAINING
Paul W. Caro, Jr. and Robert N. Isley Apr. 1966 14 p refs Presented at the 12th Ann. Meeting, Southeastern Psychological Assoc., New Orleans, 2 Apr. 1966 *Its* Profess. Paper No. 1-66
(Contract DA-44-188-ARO-2)
(AD-630484) CFSTI: HC $1.00/MF $0.50

The paper deals with a determination of the training value of certain training device concepts and techniques in Army helicopter contact flight training.
TAB

N66-25777# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Advanced Development Program.
EXPLORATORY INVESTIGATION OF THE YADOFF METHOD FOR THE REGENERATION OF OXYGEN FROM CARBON DIOXIDE
Arnold Reed Aug. 1965 29 p refs
(ADR-04-06-65.2)

This project was undertaken to verify the reported regeneration of oxygen from carbon dioxide by the interaction of electromagnetic and electrostatic fields. The electromagnetic field was established by a current carrying wire and the electrostatic field by a cylindrical grid, concentric with respect to the wire. The parameters, gas pressure and intensity of fields, were varied and the gas was analyzed for oxygen over a period of time for each setting. No oxygen was regenerated. The conclusion drawn is that the interaction of the two electric fields is not capable of producing a detectable amount of oxygen from carbon dioxide.
Author

N66-25829# Human Engineering Labs., Aberdeen Proving Ground, Md.
CHECK-READING ACCURACY: ALIGNED DIALS VS. EXTENDED-POINTER DIALS
Lynn C. Oatman May 1965 21 p refs
(TM-6-65; AD-616882) CFSTI: HC $1.00/MF $0.50

Two simulated dial displays were compared in a check-reading task. An extended-pointer dial display was compared with an aligned dial display. The two dial displays were presented to 30 subjects who were asked to indicate whether or not the display contained a deviant pointer, and, if so, to locate the deviant pointer. The data indicated that subjects performed about equally well with the extended-pointer dial display and the aligned dial display. However, the location of the deviant dial within the display was an important determinant of the number of deviant pointers detected.
Author (TAB

N66-25897# Human Engineering Labs., Aberdeen Proving Ground, Md.
RELIABILITY OF TEMPORARY THRESHOLD SHIFTS CAUSED BY REPEATED IMPULSE-NOISE EXPOSURES
David C. Hodge, R. Bruce Mc Commons, and Raymond F. Blackmer Feb. 1965 34 p refs
(TM-3-65; AD-618324) CFSTI: HC $2.00/MF $0.50

Twenty-two subjects were exposed to the same gunfire-noise condition nine times. Their auditory thresholds were measured at six frequencies from 500 to 6000 cycles per second before and after exposure, and all temporary threshold shifts (TTS) were converted to TTS2 for ease of comparison. Fluctuations in mean TTS2 were five dB or less for all frequencies across the nine exposures, but individual differences were large and the reliability coefficients were small. It was concluded that, while repeated-measurement experimental designs appear appropriate for impulse-noise studies, group data are more meaningful than data for individual subjects. Very small samples of subjects should not be used for such studies, because it is important to be able to generalize the results to the Army as a whole. Author (TAB)

N66-25914# Pittsburgh Univ., Pa. Graduate School of Business.
PSYCHOLOGICAL PREDICTIONS BASED ON BAYESIAN PROBABILITIES
Harry A. Clampett, Jr. Mar. 1966 32 p refs
(Contract Nonr-624(14))
(TR-11; AD-630314) CFSTI: HC $2.00/MF $0.50

Bayesian analysis was applied to personnel predictions in comparison to traditional regression procedures. The main advantage the Bayesian approach has over regression techniques is freedom from the homogeneity-of-variance requirement. It was seen that when the assumption of homogeneous variance is violated, the Bayesian method yields more accurate predictions than the regression method. When the assumption is tenable, the Bayesian and regression approaches yield the same results. Along with algebraic and empirical analyses, computer simulation was used to contrast Bayesian and regression predictions of dichotomous budgeting decisions from scores on intelligence tests and inventories of orientation and personal values. Author (TAB)

N66-25960# School of Aerospace Medicine, Brooks AFB, Tex.
A MINIATURIZED VHF FM/FM TELEMETRY SYSTEM Technical Report, Jun. 1963–Jun. 1965
James M. Terry and Dolfo D. Dizon Dec. 1965 16 p refs
(SAM-TR-65-84; AD-477334)

A miniature VHF FM/FM telemetry system was developed that will allow simultaneous monitoring of variable parameters. This telemetry system utilized carrier frequencies of 88 to 230 mc. The design of this telemetry system allows for transmission of a wide range of data over an appreciable distance. The telemetry system can be microminiaturized to fit into a one-tooth space. The basic design can be adapted to almost any shape, depending on its application. The transmitter was developed to study tooth contacts and jaw relation of dental patients. The transmitter is also capable of transmitting a number of other physiologic parameters simultaneously with the proper sensor. Author (TAB)

N66-25962# Northwestern Univ., Evanston, Ill. Auditory Research Lab.
MONAURAL VERSUS BINAURAL DISCRIMINATION FOR FILTERED CNC MATERIALS: THE NORMAL AUDITORY MECHANISM Technical Report, 16 Oct. 1961–15 Dec. 1964
Tom W. Tillman and Raymond Carhart Brooks AFB, Tex., School of Aerospace Med., Dec. 1965 20 p refs
(Contract AF 41(609)-2643)
(SAM-TR-65-79; AD-477337)

By using these filtered materials, a single biaural and two monaural articulation functions were derived for each of 36 normal subjects. In the binaural condition 12 subjects received only low-pass filtered materials, while 12 others received only the high-pass signal. The remaining 12 received both signals simultaneously, one to each ear, in their binaural condition. Monaural functions for the two types of signal rose with approximately equal slopes. The slopes of the binaural functions obtained for a single signal failed to differ from those of the monaural counterpart. Conversely, the slope of the binaural function for the combined signal markedly exceeded those of the monaural ones. The technic described appears promising as a means of identifying patients with central auditory lesions. Author (TAB)

N66-26122*# Honeywell, Inc., Hopkins, Minn.
TRACE MATERIAL GENERATION RATE SIMULATOR, APPENDIX B. PART B: STUDY OF GENERATION RATE PATTERNS Final Report
9 Jun. 1965 90 p refs Prepared by North Star Res. and Develop. Inst. for Honeywell
(Contract NAS9-3998)
(NASA-CR-65347) CFSTI: HC $3.00/MF $0.75 CSCL 06K

Research methodology and the results obtained by application of the methodology to the problem of estimating generation rate patterns for trace materials are presented. The trace-material sources are the material, equipment, and the men in a six-cubic-meter capsule designed for a 14-day lunar mission. The first part of the report is an exposition of the rate-controlling mechanism for the gassing of organic materials. A diffusion-controlled mechanism provides the mathematical model for calculation of gassing rates versus time. It is applied to the components of the stabilization and control system (SCS) to arrive at trace-material generation rates. A scheme was devised to use available numerical data on the toxicity of materials to obtain relative toxicity ratings. Some trace materials could then be substituted for others to arrive at a smaller list of materials for use in the TMCU. The relative toxicity ratings have been tabulated. Author

N66-26237*# Computer Concepts, Inc., Los Angeles, Calif.
THE ROLE OF COMPUTERS IN HANDLING AEROSPACE SYSTEMS HUMAN FACTORS TASK DATA Final Report, 3 Jun. 1964–3 Jun. 1965
Irvin R. Whiteman Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 196 p refs
(NASA Order R-115; Contract AF 33(615)-1557)
(NASA-CR-75081; AMRL-TR-65-206; AD-631182) CFSTI: HC $5.00/MF $1.00 CSCL 05B

The characteristics of a computer based data system for handling human factors task information generated in support of advanced system development are described. On the basis of information gathered from users and generators of data at representative Government and contractor installations, the current and potential uses of computers were assessed to determine the desirable characteristics for a computerized human factors task data handling system. The proposed data handling system will assist the human factors specialist and system design engineers in the design and development of systems by providing them with means for: (1) drawing them closer to the data through a user-oriented system, (2) comparing data generated throughout the life-cycle of an advanced system and across systems, (3) analyzing data and conducting man–machine simulations, and (4) insuring that data are made available on a selective query and a timely basis. These

objectives are met within the framework of a data system concept referred to as CENTRAL. The functions of CENTRAL are: (1) data storage and retrieval, (2) data processing, (3) computer program maintenance, and (4) system operational manual maintenance. Author (TAB)

N66-26304# Ohio State Univ. Research Foundation, Columbus.

INFERENCES ON THE BASIS OF CONDITIONALLY NONINDEPENDENT DATA Final Report

David A. Schum Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 38 p refs

(Contract AF 33(657)-10763)

(AMRL-TR-65-161; AD-630662) CFSTI: HC $3.60/MF $0.50

The experiment was concerned with decision making in a tactical threat situation (simulated). More specifically, it was concerned with the ability of subjects to estimate the likelihood of hypotheses concerning the 'adversary's' intentions being true. The data, presented to the subjects, concerning the enemy, were internally interrelated in a probabilistic sense. The purpose of the study was to evaluate the subjects' ability to exploit these interrelationships in making their estimates concerning the probable intentions of the enemy. The subjects' likelihood estimates as to the enemy's intent were compared with those computed using Bayes' theorem—a mathematical technique that, theoretically, makes maximum use of the data, their interrelationships and their relation to the hypotheses. In general, the estimates made by well-trained subjects agreed closely with those calculated from Bayes' theorem. The subjects apparently were able to exploit the probabilistic interrelationships in the data. Furthermore, the subjects' estimates reflected neither the conservatism nor the 'recklessness' suggested by other previous experiments. Author (TAB)

N66-26331# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.

PSYCHOPHYSICAL METHODOLOGY, III. DEDUCTIONS FROM THE ASSUMPTION THAT A CUMULATIVE SYMMETRICAL DISTRIBUTION UNDERLIES THRESHOLD PHENOMENA

Robert M. Herrick 31 Dec. 1965 18 p refs

(NADC-MR-6515; AD-630391) CFSTI: HC $1.60/MF $0.50

The phi–gamma and quantal hypotheses are special cases of the hypothesis of a cumulative symmetrical distribution. Assuming any cumulative symmetrical distribution it follows that: (a) a descending method of limits (DML) threshold distribution is a mirror image of an ascending method of limits (AML) threshold distribution; (b) the DML mean threshold, M_D, is higher than the AML mean threshold, M_A; (c) $M_A + M_D = S_0 + S_n$, where S_0 and S_n are the stimuli associated with p values (probability of 'Yes' response) of .00 and 1.00, respectively; (d) the median threshold of the method of constant stimuli is $(S_0 + S_n)/2$, as is the mean threshold of the pooled AML and DML distributions. Author (TAB)

N66-26340# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.

BASIC HUMAN FACTORS TASK DATA RELATIONSHIPS IN AEROSPACE SYSTEM DESIGN AND DEVELOPMENT Final Report, Aug.–Dec. 1965

L. Duncan Hannah (Am. Inst. for Res., Pittsburgh) and Lawrence E. Reed Dec. 1965 61 p refs Prepared in cooperation with Am. Inst. for Res.

(AMRL-TR-65-231; AD-630638) CFSTI: HC $3.00/MF $0.50

The generation, use, and flow of human factors task data in aerospace system design and development are described. The data are characterized by a process of continual transformation in content and form of presentation occurring throughout the iterative cycles of system development. The networks within which data flow are shown to be extensive in size, pervasive in nature, and complex in their dynamic relationships. These dynamic processes are illustrated in flow diagrams showing the relationships of human factors task data and their input/output elements in functional analysis for planning, specifications, task analysis, human engineering, reliability, maintainability, qualitative and quantitative personnel requirements information, training equipment planning information, and maintenance manuals.

Author (TAB)

N66-26532# Aberdeen Univ. (Scotland).

THE USE OF CUING IN TRAINING TASKS, PHASE II Technical Report (Final), 30 Jun. 1964–1 Oct. 1965

John Annett and Laura Paterson Port Washington, N. Y., Naval Training Device Center, Feb. 1966 82 p refs

(Contract N62558-4119)

(NAVTRADEVCEN-4119-1; AD-630260) CFSTI: HC $3.00/MF $0.75

The report falls into three sections: a review of the literature on training for auditory tasks, an account of three experiments comparing cuing and knowledge of results as training techniques for a detection task, and the comparison of cuing and knowledge of results in an intensity discrimination task.

Author (TAB)

N66-26677# Naval Training Device Center, Port Washington, N. Y.

AN ANALYSIS OF INDUCED MOTION

Leonard Brosgole Feb. 1966 66 p refs

(NAVTRADEVCEN-IH-48; AD-630275) CFSTI: HC $3.00/MF $0.75

Through an analysis of induced motion, the long standing concept of 'object-relative displacement' was rejected in favor of a new theory of motion perception which stresses egocentric location change. Several problems in movement perception (including simulated body movement) were evaluated in terms of this location change theory. Author (TAB)

N66-26684# West Texas State Univ., Canyon.

SOME INTERACTIONS BETWEEN INDIVIDUAL DIFFERENCES AND MODES OF INSTRUCTION

Wilma Jo Bush, Dolores Kathryn Gregg, Edgar A. Smith (Aerospace Med. Res. Labs.), and Coit B. Mc Bride (3320th Retraining Group, Amarillo AFB, Tex.) Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 20 p refs Prepared in cooperation with AMRL and 3320th Retraining Group, Amarillo AFB, Tex.

(Contract AF 33(615)-1460)

(AMRL-TR-65-228; AD-631138) CFSTI: HC $1.60/MF $0.50

This study explored the hypothesis that there is a relationship between patterns of learning ability and the amount learned in different instructional conditions. Scores for each of 44 subjects were obtained on (a) the Reading Vocabulary and the Mathematics Fundamentals subtests of the California Achievement Test, (b) the Administrative and the Mechanical Scales from the Airman Qualifying Examination, and (c) the Verbal and Performance Scales of the Wechsler Adult Intelligence Scale. Each of the 44 subjects also learned in five different training situations. Differences between scores on associated subtests (e.g., Reading Vocabulary minus Mathematics Fundamentals) were correlated with the difference

between gain scores obtained in the various learning situations. A significant relationship was observed between the difference on the subtests of the California Achievement Test and the difference between the gain score from lecture-like instruction and the gain score in laboratory-like instruction. The data tended to support the hypothesis that students with relative strength in Reading Vocabulary are superior to students with relative strength in Mathematics Fundamentals when both are required to learn from instructional conditions that are highly verbal. On the other hand, students exhibiting relative strength in Mathematics Fundamentals tend to learn more efficiently in individual laboratory situations than do students showing relative strength in Reading Vocabulary.
Author (TAB)

N66-26886*# Harvard School of Public Health, Boston, Mass. Guggenheim Center for Aerospace Health and Safety.
HUMAN PERFORMANCE IN ADVERSE ENVIRONMENTS
Norman H. Mackworth, Warren H. Teichner, and Ross A. McFarland Mar. 1966 39 p refs
(Grant NsG-718)
(NASA-CR-75185) CFSTI: HC $2.00/MF $0.50 CSCL 05E

To discover the factors that may limit astronaut capabilities during prolonged space flight, studies are being conducted on human performance tests that are sensitive and reliable in measuring adverse environmental effects. Test criteria are defined as: high degree of sensitivity for measuring small changes; precise physical measurements; results that are independent of the conscious or unconscious effort exerted; and functional stability during control experiments when the physiological stresses are not applied. Experiments on peripheral seeing were conducted in a low pressure chamber which reduced the oxygen content of the atmosphere to a level equivalent of 8000 feet. Eye tracks were taken from the subjects while they scanned along a strip of visual material to locate a very small square among equivalent sized small black circles on a white ground. Variations in the eye tracks indicate the need for further testing. Experiment designs are also discussed for peripheral seeing of flashing lights, and pattern matching; prolonged seeing of flashing lights, eye track coverage, and detection of texture changes; and for rules recognition for patterns, textures, and serial patterns.
M.G.J.

N66-26737# Industrial Science and Technology Agency, Tokyo (Japan).
REVIEW ON MEASUREMENTS OF AND FORMULATIONS OF COLOR DIFFERENCE
Yoshio Sugiyama Aug. 1964 66 p refs In JAPANESE; ENGLISH summary *Its* Circ. of the Electrotech. Lab. No. 156
CFSTI: HC $3.00/MF $0.75

Since Fechner's papers (1801–1887) on psychophysics, experimental and theoretical researches on color difference have been conducted by many investigators. Though some of them are now used in various fields, they are not complete. Moreover, accompanied wih the recent development of psychometrics and biophysics, the problem of color difference is being investigated from different viewpoints, such as physical, psychological and physiological. Experiments on small color differences are described. Thurstone's paper on the law of comparative judgment (1927) was the first on the psychological scaling method. Since then, many scaling methods were developed especially after World War II; the applications of them to the measurements of large color differences are summarized. Also, investigations on the theories of color difference are described and formulations of color difference are reviewed.
Author

N66-26740 Ceskoslovenska Akademie Ved, Roz.
MATHEMATICAL-LOGICAL MODEL OF VESTIBULAR AND HEARING IRREGULARITIES [MATHEMATISCH-LOGISCHES MODELL DE VESTIBULAR- UND GEHORSTORUNGEN]
Jaroslav Zelenka and Otakar Zich 1965 46 p refs In GERMAN *Its* Vol. 75, No. 9

The application of cybernetics and mathematical logic in the investigation of disturbances in the inner ear is demonstrated. The stated purpose is the precise formulation of diagnostical findings, the manifestation of the interrelation of separate problems, and a speedier arrival at conclusions. A detailed, two-part model for the investigation of vestibular and hearing deficiencies is given. The problem of vestibular disturbances is also graphically presented by the method of the logical net.
Transl. by K.W.

N66-26827# General Precision, Inc., Glendale, Calif.
AN AXIOMATIC CONCEPTUAL FRAMEWORK FOR ASSOCIATION THEORY Final Report
Richard F. Reiss (Linacre Coll., Oxford) Dec. 1965 135 p refs
(Contract AF 49(638)-1236)
(AFOSR-66-0597; AD-630429) CSFTI: HC $4.00/MF $1.00

A partially developed axiomatic system, called the SSF frame (state-space-function framework), is described, and is intended for use in formulating a general theory of psychological phenomena, particularly a theory based on associationist concepts. The chief primitive entities of the system are 'states,' 'moments of time,' and 'occurrences' of a state 'at' various moments of 'time'. A class of objects, 'bases,' is introduced for particular groups of states to enable the empirical interpretation of a 'real object' that can have or be in various observed states at various times. The base of a space is a unique object; there cannot be two or more bases in the same space and, by definition, the base of a space cannot be in two states at the same moment. A relation called an 'alinement' enables consideration of the relations between the spaces of x and y. The framework is deterministic: all functions are divided into 'formal' and 'causal,' the latter derived from the former by means of pairing and special interpretations. A main dichotomy of causal functions is that of 'first-order' vs. 'second-order' types. The notion of a 'sequential' deterministic system is developed that is consistent with the conceptual framework of state spaces and causal functions. The fundamental temporal property of a causal connection, the 'propagation delay,' is introduced and related with the delays of causal functions. The structure of a sequential function is characterized by 'autopaths' in the co-domain corresponding to subsets of the domain, namely those subsets defined by points in A for a function f:AXB→B.
Author (TAB)

N66-26844*# Hamilton Standard Div., United Aircraft Corp., Broad Brook, Conn.
MARS LANDING AND RECONNAISSANCE MISSION ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM STUDY Fourth Monthly Progress Report (33d Term)
K. L. Hower 16 Dec. 1965 232 p refs
(Contract NAS9-1701)
(NASA-CR-75250; SLS-404) CFSTI: HC $6.00/MF $1.25 CSCL 06K

This report presents the results of the main subsystem study areas of the Mars landing and reconnaissance mission environment control and life support system study. Analyses were performed on the following subsystems of an environmental control and life support system: atmospheric supply, atmospheric conditioning, thermal control, water management, and instrumentation. The data generated are

presented in parametric form to permit evaluation of each subsystem, and selection of the best subsystem in each area. Although the data are presented in summary form, they are complete enough to be used as design tools. R.N.A.

N66-26860*# North American Aviation, Inc., El Segundo, Calif.
VIBROCARDIOGRAPHIC SYSTEM STUDY Final Technical Report, 24 Jul. 1964–15 Jan. 1965
J. T. Celentano, P. R. Barker, and L. N. Wright Washington, NASA, Jun. 1966 78 p ref Prepared for Lear Siegler, Inc., Santa Monica, Calif.
(Contract NAS4-930)
(NASA-CR-504) CFSTI: HC $3.00/MF $0.75 CSCL 06B

The evaluation of a commercially available vibrophonocardiographic sensor, and the determination of the relationship between the record obtained with the sensor and the timing of mechanical cardiac events using animal subjects were undertaken. Vibrophonocardiographic (VCG) data were compared to myocardiographic (MCG), electrocardiographic, and left ventricular blood pressure data. The myocardial activity sensor modifications are mentioned. The experimental procedures of implanting the MCG sensors in dogs, the operative technique and surgical course, and the data collection are given. Both acute and chronic experiments were performed. Among the conclusions are: the MCG sensor was established as a basic tool for studying mechanical activity of the heart; the MCG sensor mounted on a suitable template could provide a tool for studying external apical vibrations when positioned on the apex; time phase shifts across the chest wall are not apparent with either the VCG or MCG; and the VCG events can be correlated to the actual mechanical events of the heart as identified by the MCG.
N.E.N.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N66-25407# India. Dept. of Atomic Energy, Bombay.
STUDIES ON THE STABILITIES AND ALLIED PROPERTIES OF ORGANIC COOLANTS
K. Narayana Rao, R. Mahadeva Iyer, K. V. S. Rama Rao, Meena Iyer, S. K. Dayal et al 1965 38 p refs
(AEET-213) CFSTI: HC $2.00/MF $0.50

The pyrolysis of pure o-terphenyl and m-terphenyl, and of commercial terphenyls with 1–10% p-terphenyls was performed for temperatures between 382° and 480°C. The results are presented in graph form. It was found that polymer formation rate is higher for the pure terphenyls than for the commercial varieties. Small amounts of organic substances were added to the commercial terphenyl to determine the influence on the radiation decomposition. The effect on melting points of additives in terphenyls was studied. The solubilities of nitrogen, hydrogen, and methane in the commercial terphenyl were determined. The results of these investigations are tabulated. Several polyphenyls required for the identification of the high boiling fractions obtained during the radiolysis of terphenyls were synthesized. N.E.N.

N66-25415# European Atomic Energy Community, Brussels (Belgium).
THE RETENTION OF ORGANIC AND INORGANIC COMPOUNDS ON CLAY MINERALS. PART I: BASIC STUDIES ON ATTAPULGUS CLAY
H. Nordmeyer Feb. 1966 104 p refs
(EUR-2646.e) CFSTI: HC $4.00/MF $0.75

With regard to organic reactor coolant purification a fundamental characterization of Attapulgus clay is given, summing up literature data as well as completing these data with an intensive study on the behavior of natural and technically activated Attapulgus clay samples at elevated temperatures. Chemical analysis, granulometry, mineralogical composition and crystal structure of the clay and clay components are reported. Thermal dehydration and phase changements with rising temperature have been followed by D.T.A., X-rays and electron micrographs. The influence of thermal activation on the dehydration process, on cation absorption and specific surface areas is demonstrated. Observations on terphenyl–clay contacts and Attapulgus grain stability are given.
Author

N66-25416# India. Dept. of Atomic Energy, Bombay. Chemistry Div.
ROLE OF SUBSTRATE SYMMETRY IN GAS–SOLID REACTIONS. PART I: REACTIONS OF GASEOUS URANIUM OXIDE WITH DIFFERENT OXIDES. PART II: STRUCTURAL INTERPRETATION OF THE REACTIONS OF GASEOUS URANIUM OXIDE
M. D. Karkhanavala and V. D. Damani 1964 28 p refs
(AEET/CD/24) CFSTI: HC $2.00/MF $0.50

The observation made in the course of a separate study of reactions between U_3O_8–ThO_2, viz. that the reaction proceeds by the intermediate formation of gaseous UO_3—has been extended to other oxides, with a view to study the effect of crystal symmetry of the substrate. Mainly, group IV oxides (SiO_2, stabilized ZrO_2, ZrO_2 and HfO_2) were used; CaO and CdO were also studied to ascertain the effect of polarizability in case of compounds with identical crystal structure and containing ions of similar radius. Al_2O_3 was used as a representative of the non-polarizable trivalent oxide group. From this preliminary study certain generalizations are made. The gaseous UO_3 reacts strongly with oxides of cubic fluorite symmetry forming a solid solution; reacts with oxides of rocksalt type forming compounds; reacts weakly with oxides of nearly cubic symmetry; does not react with oxides of none-cubic symmetry.
Author

N66-25427# India. Dept. of Atomic Energy, Bombay. Nuclear Physics Div.
STUDY OF THE ROTATIONAL BEHAVIOUR OF THE AMMONIUM ION IN SEVERAL SALTS BY NEUTRON SPECTROMETRY
G. Venkataraman, K. Usha Deniz, P. K. Iyengar, A. P. Roy, and P. R. Vijayaraghavan 1965 98 p refs
(AEET-238) CFSTI: HC $3.00/MF $0.75

The dynamics of the ammonium ion, particularly its rotational behavior has been studied in NH_4Cl, ND_4Cl, NH_4Br, ND_4Br, NH_4I, $(NH_4)_2SnCl_6$ and $(NH_4)_2SnBr_6$ using the techniques of neutron spectrometry. Neutron energy loss data obtained with a modified beryllium detector spectrometer clearly shows that the ammonium ion is performing torsional oscillations in all these salts at 100°K, the torsional frequencies being 389, 280, 335, 254, 293, 240 and 193 cm^{-1} respectively. Using the frequencies, the barrier heights for rotation have been derived. In the halides, the torsional oscillations persists above the λ point in accord with Frenkel's model for the λ anomaly. Close examination of the torsional

peak shows that there is a split which reflects on the anharmonicity of the potential. Energy gain data at 300°K has been obtained for the undeuterated salts using a rotating crystal spectrometer. Author

N66-25432# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
DIFFUSIONAL RELEASE OF TRITIUM FROM IRRADIATED BeO
K. T. Scott and L. L. Wassell Jan. 1966 14 p refs
(AERE-R-5102)

Measurements of the diffusional release of tritium from BeO on post irradiation annealing have been carried out using a flow/counting technique with helium as carrier gas and with a liquid nitrogen trap before the counter to remove any condensable species. The material examined consisted of single crystals and powder irradiated at 150°C to doses of 5×10^{19} $\rightarrow5\times10^{20}$nvt ≥ 1 MeV. Plots of fractional release against $\sqrt{\text{time}}$ yielded good straight lines after allowance had been made for initial burst effects and the equivalent sphere model was applied over the temperature ranges employed. From Arrhenius plots of log D $\alpha \frac{1}{T}$ activation energies for the diffusion process were derived. These varied from 48–59 K.cals. The results are compared with those of other authors on similar materials. Author

N66-25437# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
DESORPTION STUDIES ON GRAPHITE SURFACES IRRADIATED IN CO_2, CH_4 AND CO_2/CO/CH_4 MIXTURES
J. Bromley 1966 42 p refs
(AERE-R-5163) HMSO: 5s

Desorption between 300°C and 600°C under reaction radiation has been used to study the surface layers formed by adsorption from CO_2 and CO_2/CO/CH_4 gas mixtures on graphite. The adsorbing gas is removed by a 2 hour helium purge at the adsorption temperature and any surface memory removed between experiments by degassing at 600°C to 650°C. It has been shown, by desorption and subsequent surface oxidation, that during the surface oxide formation in pile from $^{14}CO_2$ the number of ^{14}C atoms of the gas phase which become attached to the surface by adsorption or exchange processes in only 2% of the number of oxygen atoms which adsorb to form surface oxide. Methane covers 2% of the graphite surface under irradiation but if 4% CO_2 is added to the methane 2% coverage of strongly bound surface oxide is formed and the methane coverage drops to 0.02%. After 114 hours in a 1% $^{14}CH_4$/CO/CO_2 mixture the desorbate contains some 21% of methane, and 20% of the CO and CO_2 desorbed from 300–400°C contains ^{14}C. Author

N66-25438# Institut du Radium, Paris (France). Laboratoire Curie.
METHOD OF ANALYZING THE ACTIVITY PROFILE OF A RADIOCHROMATOGRAPH [METHODE D'ANALYSE DU PROFIL D'ACTIVITE D'UN RADIOCHROMATOGRAMME]
S. Apelgot and M. Duquesne Brussels, EURATOM, Mar. 1966 32 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-030-63-3 BIOF)
(EUR-2626.f) CFSTI: HC $2.00/MF $0.50

Study of the activity profile of a radioactive solute at various stages of chromatography shows, with a pure substance, a Gaussian distribution and makes it possible to determine a law, governing the standard deviation broadening in that distribution. In a mixture, each constituent has a Gaussian activity curve, and a complex profile can be broken down into a sum of Gaussian curves. Author

N66-25462# United Kingdom Atomic Energy Authority, Harwell (England). Chemical Engineering Div.
SURFACE EXCESS IN SOLUTIONS OF SURFACE ACTIVE AGENTS. I: A COMPARISON OF STATIC AND DYNAMIC RESULTS
D. L. Banfield, M. P. Simpson, I. H. Newson, and P. J. Alder Jan. 1966 46 p refs
(AERE-R-5124)

Surface tension measurements for aqueous solutions of sodium dodecyl benzene sulphonate and sodium dodecyl sulphate are presented. Four methods of measuring surface tension were employed, viz: (1) du Noüy ring tensiometer; (2) Sugden's maximum bubble-pressure method; (3) drop weight; and (4) pendant drop. The du Noüy tensiometer is found to give incorrect results for all but pure liquids. The pendant drop technique is to be preferred for measuring truly static surface tensions. However, the drop weight method is recommended as an extremely simple method, giving reproducible results in agreement with the pendant drop technique. Results are compared in terms of the Gibbs surface excess concentration, and also with surface excess values obtained, more directly, in a dynamic foam column. Discrepancies are found between the surface excess predicted from surface tension data and that measured directly in a foam column and the relation between the two results is discussed. It is concluded that equilibria attained in a foam column between the surface and bulk phase concentrations of solutions containing surface active agents cannot be predicted simply from surface tension data. Author

N66-25487# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
HYDROFOBIZATION OF CELLULOSE BY RADIATION INDUCED GRAFTING OF STYRENE ON ITS SURFACE [HYDROFOBIZACJA CELULOZY METODA RADIACYJNEGO SZCZEPIENIA STYRENU NA JEJ POWIERZCHNI]
Zofia Bulhak and Waclaw Zielinski 1965 19 p refs In POLISH; ENGLISH summary
(Rept.-671/XVII/C) CFSTI: HC $1.00/MF $0.50

Radiation grafting of cellulose fibers by styrene bearing in mind the hydrofobization of their surfaces was carried on. The grafting was performed in pure liquid monomer and in its solutions in dioxane, chloroform and in several alcohols, at different temperatures, in air and in nitrogen gas atmosphere. The percentage function of water vapor absorbed and tensile strength of modified fibers was determined. Author

N66-25494# California Univ., Berkeley. Lawrence Radiation Lab.
AMINE HYDROHALIDE EXTRACTION STUDIES
W. Müller (EURATOM) Brussels, EURATOM, Dec. 1965 28 p refs Presented at the Gordon Res. Conf. on Ion Exchange, New London, N. H., 2–6 Aug. 1965
(Contracts EURATOM-003-61-2 TPUB; W-7405-ENG-48)
(UCRL-16254; EUR-2582.e) CFSTI: HC $2.00/MF $0.50

Equilibria between trilaurylamine dissolved in different organic diluents and aqueous dilute hydrohalic acids (HCl, HBr, HI) have been studied. For a given diluent, the equilibrium constants for the formation of the trilaurylammonium salts increase from hydrochloric to hydroiodic acid. These

constants increase according to the following order of diluents: cyclohexane—carbon tetrachloride—benzene—nitrobenzene—chloroform. The amine salts which exist usually as ion pairs may associate to higher aggregates with increasing concentration. This association decreases with increasing polarity or dielectric constant of the diluent, and from hydroiodide to hydrochloride. The water uptake by the organic phases is proportional to the amine salt concentration and decreases with increasing anion size. For a given halide, the amine salt is almost equally hydrated in cyclohexane, benzene, and nitrobenzene; the hydration decreases in carbon tetrachloride and even more in chloroform. The behavior of trilaurylamine thiocyanate is similar to that of the amine hydroiodide. The extraction of hydrofluoric acid even from dilute aqueous solutions leads to compounds which contain more than one molecule of acid per amine, and again the equilibria depend upon the nature of the organic diluent. On the basis of the above mentioned results the extraction of metals from halide solutions by amine salts is discussed. Author

N66-25498# Battelle Inst., Frankfurt am Main (West Germany).
SYNTHESIS OF C_{14}-LABELED TERPHENYLS [SYNTHESE VON KOHLENSTOFF-14-MARKIERTEN TERPHENYLEN]
E. Fischer, W. Hafferl, and M. Schmidl Brussels, EURATOM, Oct. 1965 33 p refs In GERMAN; ENGLISH summary
(Contract EURATOM-130-63-11 ORGC)
(EUR-2527.d) CFSTI: HC $2.00/MF $0.50

This report deals with tests on the synthesis of C^{14}-labeled o- and p-terphenyl. The tests showed that C^{14}-labeled terphenyls can be produced by reaction of aryl lithium compounds with cyclic ketones. Both the reaction of commercial (U)-C^{14}-bromobenzene, or (U)-C^{14}-phenyl lithium produced from it, with phenylcyclohexanone and of commercial 1-C^{14}-cyclohexanone with diphenyl lithium yielded diphenyl cyclohexanols or diphenylyl cyclohexanols which could be converted into the correspondingly marked terphenyls by catalytic dehydration and dehydrogenation. So far the following have been synthesized: (1,2,3,4,5,6)-C^{14}-o-terphenyl, (1,2,3,4,5,6)-C^{14}-p-terphenyl, 1-C^{14}-o-terphenyl and 1-C^{14}-p-terphenyl. The synthesis yield, the reaction being carried out on the 10 to 25 millimol scale, was mostly between 40% and 60%, referred to radioactive starting material. The specific activity of the labeled terphenyls ranged up to 0.25 mc/m.mol; higher values can be attained by using higher-activity starting materials. Inactive preliminary tests were performed on the synthesis of 4-C^{14}-bromobenzene from 1-C^{14}-aniline. Methods for the preparation of terphenyls labeled in the central ring are being elaborated. Author

N66-25500# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
CHEMICAL THAWING MATERIALS [CHEMISCHE ONTDOOIMIDDDELEN]
E. W. Lindeijer 2 Feb. 1966 16 p In DUTCH
(TL-1966-3; TDCK-44739) CFSTI: HC $1.00/MF $0.50

Two chemical materials (LK 2019 and Monroe X-73) were tested and compared to determine their effectiveness in removing an average 5 mm of ice from airport runways. In laboratory tests, the chemicals were applied as evenly as possible to cement tile to determine the rate of thawing. Results showed that the two materials have about the same thawing effect; however, common salt was found to have a greater effect although it is slightly more corrosive. Outdoor tests using the LK 2019 indicate that the ice cracking which occurs after application might make mechanical removal easier; 600 grams per square meter appeared to be sufficient for effective thawing. From the overall results obtained, it was concluded that the materials are only effective when evenly distributed, and when the partially melted ice and snow can be thoroughly removed by machines. Transl. by J.O.

N66-26523# Army Electronics Labs., Fort Monmouth, N. J.
CHEMICALLY DEPOSITED YTTRIUM-IRON-GARNET FILMS
William Skudera, William Wade, and Thomas Collins Feb. 1966 16 p refs
(ECOM-2667; AD-630341) CFSTI: HC $1.60/MF $0.50

Thin films of yttrium-iron-garnet and aluminum substituted yttrium-iron-garnet, ranging in thickness from 0.5 to 38 microns, were prepared by chemical deposition techniques. Major phase, firing temperature, linewidth, thickness and particle size studies were made on these films to determine and control single phase formation and to obtain a minimum ferrimagnetic linewidth for potential microwave applications. Experimental results show that the narrowest linewidth, 125 oersteds, was obtained for the film with the highest degree of major phase structure. It was also found that films with submicron as well as micron particle sizes can also be formed. Author (TAB)

N66-25537# Weizmann Inst. of Science, Rehovoth (Israel).
INFRARED SPECTRA OF HCl IN PURE AND IMPURE NOBLE GAS MATRICES: ABSOLUTE INTENSITIES Technical (Scientific) Note No. 3
J. M. P. J. Verstegen, Hanna Goldring, S. Kimel, and B. Katz (Israel Inst. of Tech.) Oct. 1965 35 p refs
(Contract AF 61(052)-838)
(AFCRL-66-37; AD-628750) CFSTI: HC $3.60/MF $0.50

High-resolution spectra were taken of the 1-0 absorption band of HCl trapped in argon, krypton, and xenon matrices in the temperature range between 6° and 50° K. The influence of impurities on such spectra was studied by introducing small quantities of a different noble gas into the matrices. A new spectral line, believed to be due to the combination of a Δ-J=0 transition with a lattice mode is reported. Absolute intensities of the 1-0 band were measured and found to be 15,000, 18,500, and 18,000 darks in argon, krypton, and xenon respectively. The spectra of HCl polymers are discussed. Author (TAB)

N66-25538# Bureau of Mines, Rolla, Mo.
THE THERMODYNAMIC PROPERTIES OF THE ZnO-Fe_2O_3-Fe_3O_4 SYSTEM AT ELEVATED TEMPERATURES. PART 2: THE THERMODYNAMIC PROPERTIES AS RELATED TO ZINC CONCENTRATE ROASTING
R. L. Benner and H. Kenworthy 1966 24 p refs
(BM-RI-6769)

A compound stability diagram was constructed for the Zn-Fe-S-O system to show the phases that should be thermodynamically stable at various temperatures, oxygen pressures, and SO_2 pressures. The diagram was demonstrated to have good qualitative value for predicting stable phases that may, in turn, be related to the recovery of zinc in the leaching phase of the electrolytic zinc process. The study showed that roasting temperature is the most significant variable in preventing roaster formation of zinc ferrite, which is directly related to subsequent extraction of zinc in the leaching step. Author

N66-25539# Bureau of Mines, Salt Lake City, Utah. Metallurgy Research Center.
VOLATILIZATION OF CESIUM CHLORIDE FROM POLLUCITE ORE
I. L. Nichols and K. C. Dean 1966 16 p refs
(BM-RI-6780)

Volatilization of cesium from pollucite ore was investigated as an initial step in the production of purified cesium metal or cesium salts. High recovery of cesium and rubidium as chloride sublimates was accomplished by 2-hour roasts in a tube furnace using charges containing 1 part ore, 2 parts limestone, and 0.23 part calcium chloride. Recoveries of cesium in the sublimate product were 89.1, 92.9, and 95.2% respectively using 1100°C and vacuum, 1250°C with an air sweep, and 1250°C without an air sweep. Most of the lithium, sodium, and potassium sublimed with the cesium and rubidium, but virtually none of the calcium, aluminum, and silicon in the charges was volatilized. Author

N66-25546*# Battelle Memorial Inst., Columbus, Ohio.
THE USE OF SILVER OXIDE AS A REGENERATIVE CARBON DIOXIDE SORBER
John F. Foster Washington, NASA, May 1966 71 p refs
(Contract NAS2-1609)
(NASA-CR-496) CFSTI: HC $3.00/MF $0.75 CSCL 07B

This study was made to develop an improved silver oxide sorbent supported on silver foil, which would retain acceptable sorption capability after repeated regenerations. Methods have been developed (1) for preforming silver foil into individual sorption modules that permit intimate contact between CO_2-contaminated air and the foil surface, (2) for oxidizing a surface layer of the foil to silver oxide, and (3) for converting the silver oxide layer to an active CO_2 sorbent. Chemical methods were developed for expanding the surface area of the silver foil before oxidation, but silver oxide formed on the expanded surface did not prove superior in sorption characteristics to oxide formed without prior surface expansion. Sorption and desorption of CO_2 by the activated silver oxide was studied in detail. No gross deterioration in sorption capacity was observed in one module that was carried through six sorption cycles, which included 740 hours at a desorption temperature of 210°C. Author

N66-25564*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
DESIGN AND FABRICATION OF A TRACE CONTAMINANT REMOVAL SYSTEM FOR APOLLO, PHASE III Final Report, Sep. 1965–Feb. 1966
14 Apr. 1966 142 p refs
(Contract NAS9-3415)
(NASA-CR-65358; M-58-65-3) CFSTI: HC $4.00/MF $1.00 CSCL 07A

Experiments were conducted to obtain points on a "potential-plot" for 15 contaminants on four sorbent materials. Two experiments were conducted to establish the CO conversion efficiencies of 1% Pt–1% Pd and 0.5% Pd catalysts in the presence of H_2S at approximately the space-cabin maximum allowable concentration. Additional experiments were conducted to determine the simultaneous oxidation efficiencies of the 0.5% Pd catalyst for CO, H_2, CH_4 and other contaminants in the temperature range of 450–550°F. Studies and experiments were also conducted to explore the possible correlation of contaminant retention-time with both saturation capacity and dynamic contaminant removal behavior. Author

N66-25589# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
WETTING AND SPREADING IN REACTIVE SYSTEMS: COPPER–PLATINUM, GOLD–PLATINUM, GOLD–NICKEL AND SILVER–GOLD
M. G. Nicholas and D. M. Poole Dec. 1965 16 p refs
(AERE-R-5101)

The secondary spreading kinetics of sessile drops in four metal–metal systems (copper–platinum, gold–platinum, gold–nickel and silver–gold) have been studied. The drop diameters increase linearly with time at rates markedly dependent on the temperature but independent of the mass. The spreading rates, S can be described as a function of temperature by an Arrhenius type expression $S = S_o e^{-Q_s/RT}$. The experimental values of Qs are in good agreement with those predicted by the model previously described by the authors (AERE-R-4843). The agreement between the predicted and experimental pre-exponential terms is poor, but the model has a high degree of success in predicting the relative order of the experimental values of So for copper–nickel and the four additional systems for which data are now available. Author

N66-25593# India. Dept. of Atomic Energy, Bombay. Spectroscopy Div.
INFRA-RED SPECTRUM OF 1, 1-DIFLUORO-2, 2-DICHLORO ETHANE
O. Santhakumari, V. B. Kartha, and N. A. Narasimham 1964 19 p refs
(AEET/Spec/9) CFSTI: HC $1.00/MF $0.50

The infra-red spectra of 1,1 difluoro–2,2-dichloro ethane are studied in the region 2.5 microns to 35 microns, on a Perkin–Elmer model 21 spectro-photometer using LiF, CaF_2, NaCl, KBr and CsBr optics. The spectra of the liquid are taken at room temperature of 27°C using conventional absorption cells of suitable thicknesses. The vapour spectrum is obtained with 10 cm and 100 cm (multiple reflection) cells at room temperature. The spectrum of the solid is obtained at liquid nitrogen temperature with a low temperature cell. A comparison of the spectra of the ethane in the vapour, liquid and solid states shows that (i) a few of the bands increase in intensity from vapour to liquid state, as expected of the bands due to the configuration possessing larger dipole moment and (ii) that these bands are still present in the solid state. These and other observations indicate that in the solid state two stable configurations exist and that their potential minima are fairly close. Some of the above results are presented in this paper. Author

N66-25612# Army Materials Research Agency, Watertown, Mass.
HIGH-TEMPERATURE EQUILIBRIUM IN THE GERMANIUM NICKEL SYSTEM AND THE DISSOCIATION ENERGY OF GeNi
Arthur Kant Dec. 1965 21 p refs
(AMRA-TR-65-33; AD-630467) CFSTI: HC $1.00/MF $0.50

The GeNi molecule has been shown to exist in the vapor phase over liquid solutions of germanium and nickel above 2000°K. Using information derived from a combination of effusion and mass spectrometric techniques, the energies and equilibrium constants of the gaseous reactions GeNi + Ge = Ge_2 + Ni and GeNi = Ge + Ni have been calculated. The values of the energy assuming a singlet sigma ground state of GeNi are GeNi + Ge = Ge_2 + Ni delta internal energy = 1.8 ± 4 kcal and GeNi = Ge + Ni dissociation energy (GeNi) = 68.4 ± 4 kcal. The dissociation energy of Ge_2 was also determined

and the value of 64.9±3 kcal confirms results obtained previously. Author (TAB)

N66-25681# Indiana Univ., Bloomington.
INELASTIC ELECTRON SCATTERING FROM ATOMS AND MOLECULES AT MEDIUM ENERGIES Final Report, 1962-1965
Russell Bonham [1965] 11 p refs
(Grant AF-AFOSR-602-64)
(AFOSR-66-0605; AD-630393) CFSTI: HC $1.60/MF $0.50

The purpose of the project was to make use of all the information that can be garnered from electron scattering from molecules to obtain detailed information about the structure of molecules. The design and construction of an electron spectrometer was undertaken. Various theoretical studies necessary for the proper interpretation of experimental results were also carried out. Achievements include the calculation of the effect of chemical binding on gas electron diffraction patterns and the experimental observation of this effect in the molecules H_2, NH_3, CH_4 and H_2O. New techniques were developed for the solution of the molecular and atomic integrals needed in the calculation of theoretical electron diffraction intensity curves for comparison with experiment. Partial wave elastic scattering factor calculations were carried out for a number of atoms and new least squares and auto correlation techniques were devised for the refined analysis of electron diffraction data in order to obtain precise molecular parameters. In addition the molecular structures of the compound $C_6Cl_4H_2$, C_6Br_6, cycloheptatriene and perylene were carried out to test these newly developed techniques. TAB

N66-25760# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, NO. 317, (SOME PROBLEMS OF RARE EARTHS CATALYSIS)
Pi-Hsien P'eng 19 May 1966 24 p refs Transl. into ENGLISH from Hua Hseuh T'ung-Pao (Peiping), no. 11, 14 Nov. 1966 p 1-8
(JPRS-35594; TT-66-32029) CFSTI: $1.00

Properties of rare earth elements are tabulated, as are the activating energies of certain alcohol and hydrocarbon reactions on these rare earths. Consideration is given to differences in electronic structures, geometric and other structural data, magnetic and electric properties, and some physical and chemical properties related to catalysis in rare earths. M.W.R.

N66-25763# International Union of Pure and Applied Chemistry, Basle (Switzerland). Commission on High Temperatures and Refractories.
HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF GASES AND PLASMAS Bibliography
L. Brewer, comp. (Calif. Univ., Berkeley) 31 Mar. 1966 34 p refs
(Rept.-18) Available from Natl. Bur. of Standards, Washington, D. C.

References dealing with spectroscopy of interest to high temperature chemistry and with reactions between gases and condensed phases are included in a bibliography on the high temperature chemistry and physics of gases and plasmas. Reports of researches conducted in the United States and abroad are listed according to titles. M.W.R.

N66-25764# International Union of Pure and Applied Chemistry, Basle (Switzerland). Commission on High Temperatures and Refractories.
HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF MATERIALS IN THE CONDENSED STATE, VOLUME 1966, NUMBER 1, JANUARY-MARCH 1966 Bibliography
J. J. Diamond, ed. (Natl. Bur. of Standards, Washington, D. C.) [1966] 69 p refs

A bibliography is presented of literature from the United States and abroad dealing with the high temperature chemistry and physics of materials in a condensed state. Metallic, nonmetallic, and mixed materials are covered. References are listed by titles under the following categories: (1) devices for achieving temperatures above 1500°C; (2) devices for measuring and controlling temperatures above 1500°C; (3) devices for physical measurements above 1000°C; (4) properties, at temperatures below 1000°C, of materials which melt above 1500°C; (5) properties, at temperatures above 1000°C, for materials which melt above 1500° C; (6) properties, at temperatures above 1000° C, for materials which melt below 1500° C; (7) phase equilibria; and (8) reactions at temperatures above 1000° C. M.W.R.

N66-25765# Bureau of Mines, Berkeley, Calif. Thermodynamics Lab.
HIGH-TEMPERATURE HEAT CONTENTS AND ENTROPIES OF TWO PRASEODYMIUM OXIDES AND THREE TERBIUM OXIDES
Louis B. Pankratz 1966 16 p refs
(BM-RI-6781)

High-temperature heat contents were measured for two praseodymium oxides and three terbium oxides. They were Pr_2O_3 (298° to 1600°K), $PrO_{1.833}$ (298° to 1050°K), Tb_2O_3 (298° to 1600°K), $TbO_{1.719}$ (298° to 880°K), and $TbO_{1.812}$ (298° to 850°K). With the exception of $PrO_{1.833}$, all results were regular. $PrO_{1.833}$ had a small thermal anomaly at 760°K with an extra absorption of 380 cal/mole. The measured heat content values, tabulated smooth heat contents, and entropy increments are reported. Heat content equations were derived. Author

N66-25770# Bureau of Mines, Berkeley, Calif. Thermodynamics Lab.
LOW-TEMPERATURE HEAT CAPACITIES AND ENTROPIES AT 298.15°K OF FERROUS MOLYBDATE AND FERROUS TUNGSTATE
William W. Weller 1966 13 p refs
(BM-RI-6782)

Heat capacities of ferrous molybdate ($FeMoO_4$) and ferrous tungstate ($FeWO_4$) were measured over the temperature range 51° to 298.15°K. Ferrous tungstate has a lambda type heat capacity anomaly at 74°K. The 298.15°K entropies are $FeMoO_4$, 30.9 cal/deg mole and $FeWO_4$, 31.5 cal/deg mole. Author

N66-25772# National Bureau of Standards, Washington, D. C.
ANALYSIS AND PURIFICATION SECTION: SUMMARY OF ACTIVITIES, JULY 1964 TO JUNE 1965
John K. Taylor, ed. 1 Oct. 1965 91 p refs
(NBS-TN-273) GPO: $0.50

This report describes the scientific programs and research activities of the Analysis and Purification Section of the Analytical Chemistry Division of the National Bureau of

Standards Institute for Materials Research. Analytical research areas include: gas analysis by mass spectrometry, polarography, coulometry, microchemistry, stoichiometry, and cryoscopy. Research in methods of purification is concerned with distillation, high-temperature phase separations, and the ultra purification of chemical reagents. The facilities and general objectives of all programs are discussed. Research accomplishments described in some detail include: modification of mass spectrometer inlet systems to facilitate analytical sampling, polarographic analysis of lead alloys, coulometric calibration of micro-volumetric apparatus, precise analysis of copper in small samples, development of apparatus for the purification of inorganic fluorides by high-temperature phase separations, and development of an adiabatic calorimeter for determination of purity of volatile substances. Author

N66-25774# Bureau of Mines, Berkeley, Calif. Thermodynamics Lab.

GLASS–CRYSTAL TRANSFORMATION OF NEPHELINE AND WOLLASTONITE AND HEAT OF FORMATION OF NEPHELINE

Ronald Barany 1966 15 p refs
(BM-RI-6784)

The heats of the glass–crystal transformation of nepheline ($Na_{0.784}K_{0.220}AlSiO_4$) and wollastonite ($CaSiO_3$) and the heat of formation of nepheline at 298.15°K were determined by solution calorimetry. For the glass–crystal transformations, the heat values were −9.0±0.3 kcal/mole for nepheline and −8.1±0.2 kcal/mole for wollastonite. The heat of formation of nepheline was −34.8±0.6 kcal/mole from the oxides and −501.0±0.5 kcal/mole from the elements. Author

N66-25775# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.

ELECTRODEPOSITION OF ALUMINUM FROM FUSED-SALT ELECTROLYTES CONTAINING ALUMINUM CHLORIDE

Philip C. Good, Marshall O. Butler and Leland A. Yerkes 1966 21 p refs
(BM-RI-6785)

Work was done to determine conditions necessary for efficient electrodeposition of aluminum from fused chloride electrolytes. Aluminum was deposited from a molten chloride salt electrolyte over a temperature range of 150° to 750°C. At lower temperatures in a heat-resistant glass cell, aluminum was deposited on stainless steel and on aluminum cathodes. The deposit was recovered in the form of light, feathery dendrites that could not be consolidated. At 750°C, molten aluminum was deposited at cathode current efficiencies as high as 90 to 100% on titanium diboride cathodes and in molten aluminum cathodes. Nitride-bonded silicon carbide was the best cell material, although porcelain was also used. The electrolyte consisted of a mixture of sodium and potassium chlorides in 1 to 1 mole ratio, containing aluminum chloride in concentrations ranging from 2 to 30 weight-percent in cells holding up to 1,000 grams of electrolyte. Generally favorable results were attained in studies made at temperatures greater than the melting point of aluminum. Author

N66-25784# Bureau of Mines, Amarillo, Tex. Helium Research Center.

METHOD OF ANALYSIS OF IMPURITIES IN HELIUM IN THE PARTS-PER-BILLION RANGE

George W. Weems and David E. Emerson 1966 14 p refs
(BM-RI-6779)

The Bureau of Mines combined preconcentrating techniques and mass spectrometry to develop a parts-per-billion general analysis of impurities in helium. The impurities are preconcentrated using a trace-impurity analyzer; and 35-mm Hg pressure of helium is left in the concentration trap to sweep the impurities into the mass spectrometry and provide a 10-mm Hg sample pressure. Author

N66-25786# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.

PREPARATION OF URANIUM MONOCARBIDE OF CONTROLLED COMPOSITION BY CARBOTHERMIC REDUCTION OF THE OXIDES IN VACUUM

N. R. Williams Dec. 1965 24 p refs
(AERE-R-5098)

The carbothermic reduction of uranium oxide in vacuum has been used to prepare uranium monocarbide suitable for the fabrication of near stoichiometric dense carbide bodies with low oxygen (<0.1 wt.%) and nitrogen (<0.05 wt.%) contents. Carbide feed material having known carbide contents in the range 4.2 to 5.2 wt.% can be provided to a predictable value ±0.05 wt.% using the stable oxide U_3O_8 and vacuum degassed graphite powders as raw materials. These latter are wet mixed and compacted for reacting at high temperature in a vacuum furnace, the temperature at which the reaction to carbide is carried out, being shown to influence the composition of the product. According to choice of carbon content, corresponding oxygen contents may range between 0.7 wt.% and 0.01 wt.% as the reaction temperature is varied from 1500 to 2000° C. The progress which has been developed is suitable for routine preparation on scales up to a 1 Kg batch. Author

N66-25792# Argentina. Comision Nacional de Energia Atomica, Buenos Aires.

A NEW COLLOID MARKED WITH P-32. ITS PREPARATION AND DISTRIBUTION IN MICE [UN NUEVO COLOIDE MARCADO CON P-32. SU PREPARACION Y SU DISTRIBUCION EN RATONES]

H. Kurcbart and R. Radicella 1965 10 p refs In SPANISH; ENGLISH summary
(CNEA-163) CFSTI: HC $1.00/MF $0.50

A ^{32}P-labelled colloid can be prepared by formation of colloidal iron hydroxide in the presence of carrier free orthophosphate-^{32}P. The colloidal solution is heated for 30 min. in autoclave at 120°C and then stabilized with gelatine. More than 97% ^{32}P is bound to the colloid. The particle size is about 800 Å. Distribution studies carried out in mice are described. Author

N66-25807# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany).

ON THE EXTINCTION EFFECT OF HALONS [UBER DIE LOSCHWIRKUNG VON HALONEN]

Richard Fiala Mar. 1966 39 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-16; DVL-507) CFSTI: HC $2.00/MF $0.50

Halons are increasingly used as an extinguishing agent in fire fighting burning fuels. The extinguishing properties of some of these Halons, of Halon mixtures, and of Halon–carbon dioxide mixtures have been compared. The reduction of the laminar burning velocity of a stoichiometrical propane–air mixture effected per concentration unit of the extinguishing

agent was applied as a standard for comparison. The influence of the initial flame conditions on the extinguishing efficiency of Halons was also investigated, varying the fresh gas temperatures, the kind of oxidizer, the oxidizer–fuel ratio and the Reynolds number of the fresh gas flow. Author

N66-25812# Weapons Research Establishment, Salisbury (Australia).
SPECTRAL STUDIES OF AROMATIC NITRO COMPOUNDS. PART III: NUCLEAR MAGNETIC RESONANCE SPECTRA OF NITROPHENOLS AND NITROANISOLES
B. H. James and P. E. Rogasch Jun. 1965 22 p refs
(CPD-99) CFSTI: HC $1.00/MF $0.50

The nuclear magnetic resonance spectra of the nitrophenols have been recorded. The effect that hydrogen bonding has on the chemical shift of the hydroxyl proton is discussed. Author

N66-25817# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Reaktorzentrum.
SEPARATION OF STABLE ISOTOPES OF RARE EARTHS [DIE SEPARATION VON STABILEN ISOTOPEN DER SELTENEN ERDEN]
E. Formann, G. Lugmair, F. Rüdenauer (Vienna Univ.), H. Wotke, and F. P. Viehböck 1965 21 p refs In GERMAN Submitted for Publication
(SGAE-PH-32/1965) CFSTI: HC $1.00/MF $0.50

The present work describes local separation, necessary because commercially available stable isotopes of the rare earths were of insufficient purity. Details are given on the mass separator which has an inhomogeneous magnetic sector field of 169°42', a logarithmic field gradient n=0.5, and a radius of the mean ion track of 1 m. The ion source is a low-volt arc source of the Freeman type. The extraction system consists of two graphite electrodes. Production was from gadolinium, erbium, and ytterbium. Ions were collected in water-cooled, graphite-lined copper pockets. Effective separation of pure isotopes reached 9.5% of initial charge material. Daily isotope production was approximately 10^{-3} mole per 24 hours of operation. Transl. by K.W.

N66-25823# Chalmers Univ. of Technology, Goteborg (Sweden).
DIFFUSION AND CAPTURE OF ARGON IN NEUTRON IRRADIATION FROM CALCIUM FLUORIDE. THE PROBLEM OF THE TRANSPORT PROCESS AND DAMAGES FROM RAYS IN FIXED BODIES [DIFFUSION UND EINFANG VON ARGON IN NEUTRONENBESTRAHLTEM KALZIUMFLUORID. ZUM PROBLEM DER TRANSPORTVORGANGE UND DER STRAHLENSCHADEN IN FESTKORPERN]
Torbjörn Lagerwall 1965 153 p refs In GERMAN; ENGLISH summary *Its* Trans. No. 307
CFSTI: HC $5.00/MF $1.00

The creation of argon from calcium by neutron irradiation and the diffusion of the argon atoms in calcium fluoride single crystals are reported. The cross section for the reaction $Ca^{44}(n,\alpha)Ar^{41}$ was determined by β–γ coincidence measurement to be 0.061 mb. The diffusion coefficient of argon in CaF_2 lattice was found from 200° to 1300°C. From diffusion measurements on Na^+- and Y^{3+}-doped CaF_2 single crystals, it was inferred that in the high temperature range the Ar atoms diffuse through the lattice by an interstitial mechanism, and that in the low temperature range a kind of nonlattice diffusion takes place. The solubility of Ar in CaF_2 was estimated from a thermodynamical consideration with the elastic continuum lattice model. The influence of radiation damage upon the Ar diffusion was studied, and the diffusion coefficient was found to decrease with increasing irradiation, up to a saturation dose. It is suggested that rare gas atoms are trapped by vacancy clusters created by irradiation. Age determinations by the K–Ar method are also discussed. N.E.N.

N66-25835# Naval Radiological Defense Lab., San Francisco, Calif.
ANALYSIS OF Cs^{134}–Cs^{137} MIXTURES BY GAMMA-RAY SPECTROMETRIC METHODS
Sachio Yamamoto 9 Jan. 1966 25 p refs
(Contract AT(49-2)-1167)
(USNRDL-TR-934; AD-630302) CFSTI: HC $1.00/MF $0.50

Cs^{134}–Cs^{137} mixtures were analyzed by gamma-gamma coincidence spectrometry and by least-squares analysis of non-coincident gamma-ray pulse-height spectra. The sensitivity and accuracy of the two methods were evaluated and compared. Particular attention was paid to mixtures with low Cs^{134} content. Known mixtures of Cs^{134} and Cs^{137}, whose Cs^{134}/Cs^{137} count-rate ratios ranged from 0.002 to 8, were prepared and analyzed by both methods. The accuracy and precision of the coincidence measurements for mixtures with count-rate ratios between 0.01 and 0.002 were 5% or better, and for ratios higher than 0.01 they were 1%. The gamma-gamma coincidence method proved to be far more sensitive than the least-squares analysis of non-coincident gamma-ray spectra. In the latter case, Cs^{134} could not be detected in mixtures with ratios below 0.01. However, the least-squares method was found to be more sensitive than other non-coincident gamma-ray spectrometric methods. It could be used to analyze mixtures with Cs^{134}–Cs^{137} ratios down to 0.01, although precision is poor at the lower range. Author (TAB)

N66-25841# Army Missile Command, Huntsville, Ala. Translation Branch.
SOME FUNDAMENTAL PROBLEMS IN CRYSTAL CHEMISTRY AND THEIR USE IN MINERALOGY
A. S. Povarennykh 25 Jan. 1966 49 p refs Transl. into ENGLISH from Zap. Vses. Mineralog. Obshchestva (Moscow), v. 84, no. 4, 1955 p 470–492
(RSIC-507; AD-629770) CFSTI: HC $2.00/MF $0.50

Analysis of the three most important problems in crystal chemistry shows that the original representations which are based on a formal-geometric theory of the formation of crystals are insufficient for explaining facts established in the last ten years of the development of this science. An attempt was made to develop more correct representations of the nature of crystal material, based on the energy properties and structure of the electron shells of the atoms. The effect was stressed on their fundamental properties on the chemical bonds between them, on which depend the effective radii and the appearance of directed bonds also. This solution to the considered problems is still rough and incomplete, partly because of the low accuracy of the energy constants for the atoms and the insufficient allowance for their mutual arrangement. Further, the effect of the metallic nature of bonds has not yet been considered, and the study covers only the simplest binary compounds of elements. Author (TAB)

N66-25860# Monsanto Research Corp., Everett, Mass.
CHEMILUMINESCENT SYSTEMS Technical Report No. 7, 1 Dec. 1965–28 Feb. 1966

John S. Driscoll and Joseph A. Pirog 15 Mar. 1966 21 p refs (Contract Nonr-4511(00); ARPA Order 299) (MRB3009Q7; AD-629886) CFSTI: HC $2.60/MF $0.50

An apparatus was constructed for the study of the heterogeneous catalysis of chemiluminescent systems. Metals (Pt, Pd, Ag) and supports (charcoal, silica, alumina) were investigated as catalysts for luminol, lophine and skatole in the DMSO, t-BuOK, O_2 system. Enhancement of light emission has not, thus far, been observed. The addition of a sensitizing agent (fluorescein) to the heteroganeous systems increased the light output relative to the unsensitized systems.

Author (TAB)

N66-25871# Heidelberg Univ. (West Germany).

POLYMERIC SULFUR-COMPOUNDS, PHOSPHORUS-COMPOUNDS, CARBON–NITROGEN-COMPOUNDS Summary Report, May, 1960–Feb. 1963

R. Appel, G. Eisenhaure, H. Gerber et al Wright-Patterson AFB, Ohio, AF Mater. Lab., Dec. 1965 66 p refs (Contract AF 61(052)-361) (AFML-TR-64-368; AD-629761) CFSTI: HC $6.60/MF $0.75

The following bi-functional compounds were synthesized as starting materials for the synthesis of inorganic polymers with sulphur–nitrogen–carbon bonds: sulfuryl–diisocyanate, $O_2S(NCO)_2$; amidosulfuric acidisocyanate, H_2NSO_2NCO; chlorosulfuryl-isocyanate, $ClSO_2NCO$; fluorosulfuryl-isocyanate, FSO_2NCO; imido-bis-sulfuric acid chloride, $HN(SO_2Cl)_2$, and imido-bis-sulfuric acid fluoride, $HN(SO_2FO_2)$. The polyaddition of diamines and diols with $O_2S(NCO)_2$ results in polymers which are not very stable to temperature and hydrolysis. The polymers found by reaction of H_2NSO_2NCO with urea and sulfamide, $O_2S(NH_2)_2$, likewise, are not very stable. In the field of the phosphorus–nitrogen-compounds the synthesis of triphenylphosphine–imines and of N-halogen–phosphine imines is described. Further experiments deal with antimony–nitrogen compounds and their reactions.

Author (TAB)

N66-25878# Space-General Corp., El Monte, Calif. Chemical and Biological Div.

A SIX-BORON CARBORANE $(CH_3)_2C_2B_6H_6$ AND $B_6H_{10}{\cdot}P(C_6H_5)_3$ FROM HEXABORANE-10

Robert E. Williams and F. James Gerhart 1 Jun. 1965 9 p refs Submitted for Publication (Contract Nonr-4381(00)) (TR-7; AD-615959) CFSTI: HC $1.00/MF $0.50

The synthesis of the carborane $C_2B_6H_8$ (Dicarbaclovooctaborane-8), which was expected to be thermally quite stable, was approached from several standpoints. Heating mixtures of B_6H_{10} (Hexaborane) and ethylene resulted only in a very slight decomposition of hexaborane. The reaction of hexaborane with $(C_6H_5)_3P$ (Triphenylphosphine) gave the adduct $B_6H_{10}{\cdot}P(C_6H_5)_3$ (m.p. 168–171°C). Mass spectroscopy of the reaction products of mixtures of hexaborane plus 1,2-dimethyl acetylene revealed the presence of $(CH_3)_2C_2B_6H_6$ (m.p.–58 to –63°C). A structure for the latter compound is proposed. TAB

N66-25884# McGill Univ., Montreal (Quebec).

ATOM RECOMBINATION ON SURFACES Final Report, Mar. 1963–Aug. 1965

James E. Morgan and H. I. Schiff Nov. 1965 47 p refs (Contract AF 19(628)-2425) (AFCRL-66-64; AD-630339) CFSTI: HC $2.00/MF $0.50

The recombination coefficients of atomic hydrogen, nitrogen and oxygen on stainless steel, nickel, chromium and titanium were estimated from measurements of the energy dissipated at the test surface. The test specimens were in the form of cylindrical probes containing heating elements and small bead thermistors as temperature sensing elements. Changes in temperature of the test probes of less than 0.02° C could be readily detected. Values of the measured recombination coefficients varied from 0.05 (O on Ni) to less than 0.0001 (H, and N on Ti). Author (TAB)

N66-25893# Naval Ordnance Test Station, China Lake, Calif.

QUANTUM MECHANICS OF HO_2. IV. CHAIN PROGRAM

D. S. Villars Jan. 1966 158 p refs (NAVWEPS-8986; NOTS-TP-3953; AD-630458) CFSTI: HC $15.40/MF $1.00

The report updates descriptions of main programs and subroutines for six chain links for the complete ab initio solution of a configuration interaction problem of HO_2 discussed in the preceeding reports of this series.

Author (TAB)

N66-25907# Airtron Inc., Morris Plains, N. J.

HYDROTHERMAL GROWTH OF CRYSTALS OF $LaAlO_3$ Semiannual Technical Summary Report, 1 Jul.–31 Dec. 1965

[1965] 33 p refs (Contract Nonr-4616(00); ARPA Order 306-62; Proj. Defender) (RII-503; AD-630259) CFSTI: HC $3.60/MF $0.50

Large single crystals of pale yellow $LaAlO_3$ (undoped) measuring approximately 1/2" by 1/2" by 1/4" were successfully grown in a 250 ml crucible from a Bi_2O_3–B_2O_3 flux. The ratio of B_2O_3 to Bi_2O_3 was an important consideration in the composition of the melt; compositions consisting of about 19 m % B_2O_3 appeared to produce the best growth. Larger B_2O_3 ratios produced a glassy melt from which no crystals grew while pure Bi_2O_3 yielded numerous small crystals no larger than 1 mm^3. Weight gains of up to 36% have been achieved in the hydrothermal system using flux grown seeds. Hydrothermally reacted and sintered $LaAlO_3$ pellets have been tried as nutrient. Also a hot pressed mixture of the component oxides was tried. Neither approach was completely successful, but each method shows some merit. One large autoclave failed due to cracks in the seal area during the report period. It has been rebored, fitted with a liner and water tested successfully. Optical absorption and fluorescence measurements have been made on flux and hydrothermally grown samples of $LaAlO_3$:Cr and on undoped flux grown $LaAlO_3$. The hydrothermally grown samples appear green due to the presence of a transmission band at 5300 Å. Author (TAB)

N66-25918# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

SENSITIVITY OF EXPLOSIVES TO MECHANICAL EFFECTS AND METHODS OF INCREASING THEIR STABILITY

G. T. Afanas'ev, V. K. Bobolev, and I. A. Karpukhin 20 May 1965 9 p refs Transl. into ENGLISH from the publ. "Vzryvnoe Delo" (Moscow), Gosgortekhizdat, 1963 p 5–10 (Contract NOw-62-0604-c) (TG-230-T451; TT-66-60762; AD-630028) CFSTI: HC $1.00/MF $0.50

Several methods of decreasing the sensitivity of explosives are presented. TAB

N66-25923# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astrophysics Lab.
UPPER LIMITS FOR CHEMILUMINESCENCE FROM SINGLE COLLISIONS OF O_3 WITH NO, CO, H_2S, and CS_2
Halstead Harrison and D. M. Scattergood Jan. 1966 26 p refs
(DI-82-0480; AD-630017) CFSTI: HC $2.00/MF $0.50

Double modulated, crossed molecular beam experiments were performed which permit upper limits to be set for the production of light from single, thermal energy collisions of ozone with nitric oxide, carbon monoxide, hydrogen sulfide, and carbon disulfide. Minimum detectable signals were limited by background light levels from a temperature sensitive surface reaction involving ozone. With the apparatus walls cooled by liquid nitrogen, this reaction still generated a partially single-modulated detector noise whose dc count rate was 100/sec. Beam densities were determined with an electron-ionization stagnation detector, operated at 20 cps, and photomultiplier luminous efficiency was measured by comparison with a standard lamp. Author (TAB)

N66-25925# Illinois Univ., Urbana. Dept. of Chemistry and Chemical Engineering.
NMR METHODS FOR DETERMINING CHEMICAL EXCHANGE RATES
Adam Allerhand, H. S. Gutowsky, J. Jonas, and R. Meinzer 26 Jan. 1966 38 p refs Submitted for Publication
(Contract Nonr-1834(13))
(TR-88; AD-630077) CFSTI: HC $3.60/MF $0.50

Factors which affect the accuracy of high-resolution and spin-echo nmr determinations of chemical exchange rates are analyzed and discussed, including mathematical as well as experimental aspects. Numerical methods show that most of the mathematical approximations commonly used to evaluate exchange rates from high-resolution spectra are subject to systematic error, and circumstances under which the error become serious are presented. A line-width equation is derived which gives accurate exchange rates in the vicinity of the coalescence point for an uncoupled AB system, and from which the chemical shift at the coalescence point can be obtained. The effects of saturation broadening are calculated and compared with experiment. In general, it appears desirable to determine exchange rates from high-resolution spectra by using computerized, complete line-shape fitting methods which do not neglect spectral complications unless their effects are demonstrably less than other inaccuracies in the rates. In rate determinations by the spin-echo method which employs a Carr–Purcell train of echoes, it is possible for self diffusion to cause systematic error. Simple criteria are presented for estimating and minimizing such effects. Other presently known factors peculiar to the spin-echo method, including the effects of finite pulse widths, do not appear to present serious problems. Author (TAB)

N66-25974# Atomics International, Canoga Park, Calif.
INTERACTION OF MERCURY AND METAL HYDRIDES
W. L. Korst 31 Aug. 1965 6 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-Memo-11569) CFSTI: HC $1.00/MF $0.50

A brief review of the literature concerning the interaction of mercury with metal hydrides is given. Particular emphasis is given to the rare earth hydrides, which possess many of the characteristics typical of transition metal hydrides. Mercury wets transition metal hydrides, apparently forming dispersions rather than true solutions. The rare earth hydride dispersions in mercury evolve hydrogen when heated, and react vigorously with air and with water. Formation of ternary compounds (R–H–Hg) on the surface of rare earth hydride particles in mercury apparently occurs. Author (NSA)

N66-25985# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
SYNTHESIS AND PURIFICATION OF SOME ALKYLPHENANTHRENES AND PRESENTATION OF THEIR INFRARED, ULTRAVIOLET, NUCLEAR MAGNETIC RESONANCE AND MASS SPECTRA [SYNTHESE ET PURIFICATION DE QUELQUES ALCOYLPHENANTHRENES ET PRESENTATION DE LEURS SPECTRES D'ABSORPTION INFRAROUGE, ULTRAVIOLETTE, DE RESONANCE MAGNETIQUE NUCLEAIRE ET DE MASSE]
Kim Persaud (Ph.D. Thesis—Grenoble Univ.) [1965] 205 p refs In FRENCH
(CEA-R-2770)

Phenanthrene, its five monomethyl derivatives, three dimethyl derivatives, and two trimethyl derivatives were prepared and purified. Low voltage mass spectrometry was used to establish purity at 99.5 per cent or better in most cases. The infrared, ultraviolet, nuclear magnetic resonance, and mass spectra of these products were recorded. Author (NSA)

N66-25995# Union Carbide Nuclear Co., Tuxedo, N. Y. Mining and Metals Div.
RADIOCHEMISTRY OF SELENIUM
V. J. Molinski and G. W. Leddicotte Washington, D. C., AEC, Nov. 1965 55 p refs Prepared for Natl. Acad. of Sci.—Natl. Res. Council
(Contract W-7405-ENG-26)
(NAS-NS-3030, Rev.) CFSTI: HC $1.00/MF $0.50

A review is presented on nuclear and chemical properties of Se, methods of sample dissolution and of separation reactions, descriptions of counting techniques, and radiochemical separation procedures for Se. 81 references are cited. NSA

N66-26020# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
CONTRIBUTION TO THE STUDY OF THE URANIUM–HYDROGEN SYSTEM [CONTRIBUTION A L'ETUDE DU SYSTEME URANIUM–HYDROGENE]
Jacques Chevallier (Ph.D. Thesis—Grenoble Univ.) 20 Jan. 1965 54 p refs In FRENCH
(CEA-R-2777)

The $U–H_2–UH_n$ equilibrium was investigated at pressures below one atmosphere and at temperatures lower than 430°C. The hydride obtained at equilibrium is deficient in hydrogen ($UH_{n<3}$), the hydrogen deficit increasing as the temperature rises. The thermodynamic increases relative to the formation and the saturation of the hydride and to the formation of a hydrogen vacancy were derived from the equilibrium pressures. A U–H phase diagram model was proposed. The hydrogenation of U–UC alloys was also examined at pressures below one atmosphere with regard to the equilibrium: (free U+UC)–H_2–UH_n. The equilibrium conditions were found different from that observed for pure uranium. Author (NSA)

N66-26022# Eidgenoessiches Institut für Reaktorforschung, Wurenlingen (Switzerland).
A CONTRIBUTION TO THE MECHANISM OF DISSOLUTION AND DIFFUSION OF OXYGEN IN ZIRCONIUM

W. W. Doerffler Sep. 1965 34 p refs
(EIR-82)

Values of the diffusion coefficient of oxygen in zirconium were determined from the dissolution rates of anodic oxide films in vacuum at elevated temperatures and from the penetration of oxygen in thermally oxidized specimens as a function of time of oxidation. Further information about the distribution of oxygen in the metal was obtained from studies of the proton radioactivation of oxygen-18. Diffusion coefficients at 550 and 600°C calculated from the depth of penetration of oxygen in the metal were found to be of the same order of magnitude as the values of diffusion coefficients calculated from the dissolution rates of anodic oxide films. Preferential line diffusion along grain boundaries, which was detected by using the nuclear reaction $^{18}O(p,n)^{18}F$, caused oxygen to diffuse into perfect lattice areas from more than one direction. These areas, therefore, fill up with oxygen relatively fast. The rate of oxide growth as a function of oxygen dissolved in the metal and of the diffusion coefficients of oxygen in the metal and in the oxide is discussed. NSA

N66-26024# Iowa State Univ. of Science and Technology, Ames.

ELECTROCAPILLARITY STUDIES OF SYMMETRIC ALIPHATIC MOLECULES ON MERCURY

Gordon Webster Potter, Jr. (M.S. Thesis) Nov. 1965 69 p refs
(Contract W-7405-ENG-82)
(IS-T-66) CFSTI: HC $3.00/MF $0.75

Interfacial data were taken for 3-pentanol and 3-pentanone. The adsorption properties for these compounds were very similar to similar data for 1-pentanol giving evidence that reorientations are slight if they do occur. A new method of analysis was used for determining the free energy of adsorption. It was found that a model of inert gas adsorption on solids could be applied successfully to the data. A new charge function was derived and experimental form of the data was shown to be correct by theoretical analysis. No evidence was found for reorientation, but a new model involving the presence of ion within the Inner Helmholtz Region is proposed to account for the variation of the surface excess with polarization. Three-pentanol was observed to be a 2-dimensional analog of a Boyle gas under experimental conditions. Author (NSA)

N66-26025# Iowa State Univ. of Science and Technology, Ames.

DIFFUSION OF HYDROGEN IN BARIUM METAL

Charles Clifford Hammerberg (M.S. Thesis) Nov. 1965 32 p refs
(Contract W-7405-ENG-82)
(IS-T-61) CFSTI: HC $2.00/MF $0.50

The diffusion coefficients for hydrogen in barium metal were measured from 200 to 620°C. D_0 was found to be 4.0×10^{-3} and ΔH was 4.54 kcal. The solubility limit of BaH_2 in barium was determined in the same temperature range and was in agreement with previous measurements. Author (NSA)

N66-26029# Mound Lab., Miamisburg, Ohio

PENTAERYTHRITOLTETRANITRATE: A BIBLIOGRAPHY

Melvin R. Kantz 30 Jul. 1965 20 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1252) CFSTI: HC $1.00/MF $0.50

References (176) on pentaerythritol tetranitrate and its homologs are given to journals and reports published from 1958 through 1964. A few pertinent references prior to 1958 are also included. Separate author and subject indexes are given. NSA

N66-26065# India. Dept. of Atomic Energy, Bombay. Chemistry Committee.

PROCEEDINGS OF THE NUCLEAR AND RADIATION CHEMISTRY SYMPOSIUM, 1964

7 Oct. 1965 129 p refs Symp. held at Bombay, 16–19 Mar. 1964
CFSTI: HC $4.00/MF $1.00

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30. STUDY OF ELECTRO-DIFFUSION OF CADMIUM IONS BY TRACER TECHNIQUE B. M. Shukla and R. P. Gupta p 149–153 refs

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36. A RADIOACTIVE INDICATOR STUDY OF THE ESTIMATION OF PHOSPHORUS AT ULTRAMICRO CONCENTRATION LEVEL K. R. Kar and M. M. Bhutani p 180–185 refs

37. COMPARATIVE EFFICIENCY OF ULITIZATION OF PHOSPHATE FROM NITRIC-PHOSPHATE, DICALCIUM PHOSPHATE AND SUPER PHOSPHATE AS REVEALED BY TRACER STUDIES M. B. Kamath p 186–189 refs

38. IN VIVO INCORPORATION OF P^{32} INTO CHICKEN SERUM PHOSPHOLIPIDS U. K. Misra p 190–194 refs

39. MOBILITY OF SUPERPHOSPHATE P IN SOILS AS AFFECTED BY INCUBATION WITH ORGANIC MATTER B. V. Subbiah and Surendra Mohan p 195–198 refs

40. STABLE STRONTIUM IN SEA WATER BY ACTIVATION TECHNIQUE S. R. Rao, A. A. Kahn, and P. R. Kamath p 199–204 refs

41. SEARCH FOR AN ISOMER OF Au^{199} K. P. Gopinathan p 205–207 refs

N66-26068# Bureau of Mines, Pittsburgh, Pa.
FLAMMABILITY CHARACTERISTICS OF SELECTED HALOGENATED HYDROCARBONS
H. E. Perlee, G. H. Martindill, and M. G. Zabetakis 1966 20 p refs
(BM-RI-6748)

Autoignition temperatures and limits of flammability of nine halogenated hydrocarbons in atmospheres of air, oxygen, and nitrogen tetroxide were measured in a modified standard autoignition apparatus and limit-of-flammability apparatus previously developed at the Bureau of Mines. Of the nine halogenated hydrocarbons investigated—bromochloromethane, bromotrifluoromethane, bromochlorodifluoromethane, 1,1,2-trichlorotrifluoroethane, 1-bromo-1-chloro-2,2,2-trifluoroethane, dibromodifluoromethane, 1,2-dibromo-1,1,2,2-tetrafluoroethane, 1,1,1,3,3-pentachlorotrifluoropropane, and 1-bromo-2,4-dichloro-1,1,2,3,3,4-hexafluorobutane—two formed flammable mixtures with nitrogen tetroxide and six with oxygen; none formed flammable mixtures with air. Three of the halogenated hydrocarbons formed no flammable zones with any of the three oxidizing atmospheres. For those halogenated hydrocarbons that supported combustion in oxygen atmospheres, explosion pressures developed during constant-volume burning of mixtures near the middle of the flammable zone were observed to range from about 6 psig for dibromodifluoromethane to 158 psig for 1-bromo-1-chloro-2,2,2-trifluoroethane. In all cases, the calculated burning velocities of these mixtures were less than 8 in/sec.
Author

N66-26124*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXPERIMENTAL PROCEDURES FOR MOLECULAR WEIGHT DETERMINATION BY LIGHT SCATTERING
W. H. Beattie (Calif. State Coll., Long Beach), R. K. Laudenslager, and J. Moacanin 1 Jan. 1966 73 p refs
(Contract NAS7-100)
(NASA-CR-74997; JPL-TM-33-242) CFSTI: HC $3.00/MF $0.75 CSCL 07C

The experimental procedures for determining molecular weights of polymers from the angular dependence of light scattering are described in detail. A Brice-Phoenix Light Scattering Photometer, which was modified to optimize its performance, was used to study the molecular weight of a sample of polystyrene distributed by the National Bureau of Standards. Results of the study are given.
Author

N66-26181# Bureau of Mines, Minneapolis, Minn.
MAGNETIC ROASTING OF IRON ORES WITH FERROUS SCRAP
M. M. Fine and Charles Prasky 1966 29 p refs
(BM-RI-6764)

This Bureau of Mines report describes the theory, experimental procedures, and the results obtained to date in the development of the Bureau's process for magnetically roasting iron ores using scrap iron as a means of reduction. Since magnetic separation is an operational step common to magnetic taconite plants, the preliminary research studies emphasized only the novel magnetic roasting step. The studies included the use of automobile scrap, ferrous reductants such as borings and turnings, and prereduced pellets. Technical feasibility of the process was demonstrated both on a bench- and pilot-scale. Quality magnetic concentrates with recoveries of over 90 percent were obtained from a direct shipping ore containing 59.5% Fe and from fine grained semitaconites with about 30% Fe. Author

N66-26184# Bureau of Mines, Reno, Nev. Metallurgy Research Center.
FUSED-FLUORIDE ELECTROWINNING OF THORIUM-BASE ALLOYS
D. G. Kesterke, D. C. Fleck, and T. A. Henrie 1966 22 p refs (BM-RI-6789)

Low-melting thorium-base binary alloys or metal solutions were prepared by two different techniques involving the electrolysis of ThO_2 dissolved in fluoride melts. Experiments were performed at 950° to 1250°C using electrolytes containing ThF_4 and various alkali and alkaline earth fluorides. In the first method, electroreduction of ThO_2 and deposition of thorium on a nickel or iron cathode formed a molten alloy that dripped off and collected on the bottom of the cell, or in a tungsten cup. An electrocodeposition technique was used to prepare thorium-base alloys or solutions containing nickel, iron, chromium, or manganese. Electrolytic reduction of the component metal oxides and simultaneous deposition of the two metals on a tungsten cathode yielded a liquid alloy product. Complementary experiments were performed on the fused fluoride electrowinning of dendritic thorium from ThO_2 at 1075° to 1200°C in which thorium crystals were recovered and arc-melted into buttons. Major contaminants were aluminum, carbon, copper, iron, oxygen, and silicon, totaling 0.2 percent. Author

N66-26248*# Sperry Rand Research Center, Sudbury, Mass.
DEVELOPMENT OF CHEMICAL ANALYSIS TECHNIQUES FOR ADVANCED MATERIALS RESEARCH PROGRAM Final Report, 1 Dec. 1964–28 Feb. 1966
Fredric D. Leipziger Mar. 1966 48 p refs Prepared for JPL (Contracts NAS7-100; JPL-950992)
(NASA-CR-75095; SRRC-CR-66-4) CFSTI: HC $2.00/MF $0.50 CSCL 07D

A series of spark source mass spectrographic procedures have been developed in an effort to specify reliable analytical techniques for the determination of bulk impurities in refractory oxides. These include the determination of gases and bulk impurities in both solid and powdered specimens. The accuracy of the mass spectrographic methods has been checked by emission spectrography, wet chemistry, and vacuum methods.
Author

N66-26257*# Pyrogenics, Inc., Woodside, N. Y.
A STUDY OF THE USE OF VAPOR AND VACUUM DEPOSITION TECHNIQUE FOR THE DEVELOPMENT OF HIGH STRENGTH FILAMENTARY MATERIALS Summary Technical Report, May 21, 1964–May 21, 1965
E. J. Hughes [1965] 39 p refs
(Contract NASw-927)
(NASA-CR-75022) CFSTI: HC $2.00/MF $0.50 CSCL 07A

An original approach to the deposition of pyrolytic graphite thin films using a liquid metal substrate is described. The advantages of using such a substrate and the factors influencing the choice of substrate material are discussed. Initial attempts to deposit on molten platinum were unsuccessful due to a reaction between the substrate and the deposited graphite. Using a molten gold substrate, however, and depositing from methane using argon at a pressure of 50 cms Hg as a carrier gas, a number of successful deposition experiments were carried out. Some subsidiary experiments on the use of solid metallic substrates are described and discussed. Author

N66-26302# Air Force Cambridge Research Labs., Bedford, Mass. Solid State Sciences Lab.
EXPERIMENTAL STUDY OF ZONE REFINING OF THE BINARY SYSTEM TRIPHENYL ANTIMONY–NAPHTHALENE
Marvin S. Brooks and Willard R. Hancock (Philco Corp., Lexington, Mass.) Jan. 1966 77 p refs *Its* Phys. Sci. Res. Papers No. 190
(AFCRL-66-63; AD-630609) CFSTI: HC $3.00/MF $0.75

An experimental study on the zone refining of the binary system triphenyl antimony–naphthalene is described. The isotope Sb^{124}, which is a strong gamma emitter, was employed as a tracer; this allowed a rapid in situ nondestructive analysis, closely spaced experimental points, and the opportunity to study distribution as a function of varying experimental conditions. With the aid of computers apparent k's were calculated and the experimental data compared with those predicted from various mathematical models.
Author (TAB)

N66-26303# IIT Research Inst., Chicago, Ill.
INVESTIGATION OF CHARGE NEUTRALIZATION PHENOMENA BETWEEN POSITIVE AND NEGATIVE IONS Final Report, 20 May 1963–30 Dec. 1965
Carsten M. Haaland Bedford, Mass., AFCRL, Dec. 1965 46 p refs
(Contract AF 19(628)-3252)
(AFCRL-66-159; AD-630904) CFSTI: HC $2.00/MF $0.50

The report describes a technique for the measuring positive ion–negative ion two body reaction rates, which was developed for measuring the reaction rates of NO^+ with O_2^-. Thermal not ions are produced by photoionization of NO and photoelectrons produced in separate chamber containing oxygen are allowed to attach to the neutral gas to produce O_2^-. The two species are allowed to react by removal of a gas actuated shutter dividing the two chambers. The reactant period by actuation of a second shutter which separates the reaction chamber from a time of flight mass spectrometer. The time of flight mass spectrometer was modified to provide a 100 kc/sec sample rate, a theta pinch lyman-alpha light source was developed, and the shutter speeds of 10,000 cm/sec were attained. Author (TAB)

N66-26317# Case Inst. of Tech., Cleveland, Ohio.
DEPOSITION OF CARBON ON DIAMOND SEED CRYSTALS Final Report, 1 Jan.–31 Dec. 1965
John C. Angus 31 Jan. 1966 24 p refs
(Contract AF 19(628)-4785)
(AFCRL-66-107; AD-630705) CFSTI: HC $2.60/MF $0.50

Initial experiments were performed to confirm and extend the previously reported low pressure growth of diamond seed crystals. Growth is accomplished by deposition of carbon from hydrocarbon gases at temperatures and pressures near 1000°C and 1 mm of mercury respectively. Increases in weight of the diamond seed crystals have been observed, but the structure of the deposit has not been conclusively identified as diamond. Author (TAB)

N66-26365# Army Chemical Center, Edgewood, Md. Chemical Research and Development Labs.

A GLASS DISTRIBUTOR FOR LARGE CHROMATOGRAPHIC COLUMNS Technical Report, Apr. 1963–Mar. 1964

Norwood K. Schaffer, A. R. Mitchell, and Frank G. de Cesare Jun. 1965 7 p refs

(CRDLR-3291; AD-615740) CFSTI: HC $1.00/MF $0.50

A glass distributor incorporating a sintered-glass disc is described. Component parts of the assembly consist of a glass tube inserted through a sintered-glass disc, three stabilizing, glass-rod side arms, and flanges on both sides of the tube securing it to the disc. The distributor permits the rapid addition of a large volume of sample to the surface of an adsorbent in a chromatographic column of a wide diameter. Author (TAB)

N66-26387# Battelle-Northwest, Richland, Wash. Chemical Research Section.

NICKEL ELECTROPLATING ON URANIUM: SURFACE PREPARATION AND PLATING SOLUTION STUDIES

J. R. Lundquist and R. W. Stromatt Oct. 1965 36 p refs

(Contract AT(45-1)-1830)

(BNWL-124) CFSTI: HC $2.00/MF $0.50

An improved method for nickel electroplating on urnaium is described. It was found possible in the laboratory to prepare adherent 11-μ thick plates with porosities equivalent to the porosity of 18-μ plates prepared by the standard procedure. An improved anodic etch solution, 0.32 M HCl in 6.0M H_2SO_4 is used. This treatment not only provides a uniform, finely etched surface, but does so with the dissolution of less uranium metal than with the H_3PO_4–HCl anodic etch treatment. Bromide is substituted for the chloride normally present in the conventional Watts nickel plating bath. An X-ray fluorescence technique for the determination of relative porosity of nickel plated uranium specimens was also developed. The specimen is briefly anodized in a $K_4Fe(CN)_6$–KNO_3 solution, and the resulting uranyl ferrocyanide precipitate at the pore sites is determined by measurement of the intensity of the X-ray fluorescence from the iron component of the precipitate. NSA

N66-26400# Iowa State Univ. of Science and Technology, Ames.

ISOTOPIC EXCHANGE STUDY OF TUNGSTEN IN A SODIUM METATUNGSTATE-SODIUM ORTHOTUNGSTATE AQUEOUS SYSTEM

Yvonne Maria Jones (M.S. Thesis) Aug. 1965 58 p refs

(Contract W-7405-ENG-82)

(IS-T-68) CFSTI: HC $3.00/MF $0.50

Isotopic exchange was studied for ^{185}W between the orthotungstate ion, WO_4^{-2}, and the metatungstate polymeric ion, $[H_2W_{12}O_{40}]^{-6}$ in unbuffered solutions of their sodium salt. Under these conditions, pH>6.5 at 25°C, the metatungstate ion was slowly decomposed into the WO_4^{-}. No isotopic exchange was detectable in a period of 720 hours, and an upper limit to a second order exchange rate constant can be set as 1.3×10^{-7} M^{-1} sec^{-1}. Author (NSA)

N66-26456# Oak Ridge National Lab., Tenn.

INDEXES TO THE ANALYTICAL CHEMISTRY DIVISION ANNUAL PROGRESS REPORTS, 1964–1965

Helen P. Raaen and Ann K. Haas, ed. Jan. 1966 72 p refs

(Contract W-7405-ENG-26)

(ORNL-3904) CFSTI: HC $3.00/MF $0.75

Cumulative key word and author indexes to the annual progress reports from the Analytical Chemistry Division at ORNL are given for the periods following Nov. 15, 1963 including ORNL-3750 and -3889. The Key Word Index was prepared both from the numbered headings that appear within the reports and from the titles of the entries in the Presentation of Research Results and in the Translations. The form of the entries is that of a permuted title index. NSA

N66-26459# Kansas Univ., Lawrence.

RADIOCHEMISTRY RESEARCH Final Report, 1 Jun. 1965–31 May 1965

[1965] 27 p refs

(Contract AT(11-1)-407)

(TID-22532) CFSTI: HC $2.00/MF $0.50

Developments are reported for studies on: reactions of recoil tritium atoms; radio gas chromatography; production and use of radioactive tracers; hot atom chemistry of ^{212}Pb, ^{131}I, and ^{38}Cl; and hot atom reactions in geochemical studies. NSA

N66-26466# California Univ., Berkeley. Lawrence Radiation Lab.

SPECTRA OF CaO

Robert H. Hauge (Ph.D. Thesis) Oct. 1965 49 p refs

(Contract W-7405-ENG-48)

(UCRL-16338) CFSTI: HC $2.00/MF $0.50

Photographic extreme-infrared bands of CaO were characterized by a vibrational and rotational analysis as part of a known $A^1\Sigma$–$X^1\Sigma$ transition. Isotopic shifts with ^{18}O were measured for the infrared and green bands. Head measurements for the orange system are given. A discussion of low-lying levels of CaO and a way of determining the absolute v numbering in levels which perturb the $A^1\Sigma$ state are presented. Author (NSA)

N66-26480# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

SODIUM MASS TRANSFER. XVII: THE DETERMINATION OF HYDROGEN IN LOOP SODIUM AND COVER GASES

D. Dutina and J. L. Simpson Jun. 1965 18 p refs

(Contract AT(04-3)-189)

(GEAP-4833) CFSTI: HC $1.00/MF $0.50

A modified version of the diffusion gasometric technique was set up for the measurement of hydrogen in sodium sampled from the mass transfer loops. A major innovation was the use of gas chromatography, a specific method for the determination of hydrogen in place of the non-specific manometric techniques used previously. The sensitivity of the technique is about 1 ppM when a 5 gram sample of sodium is used and the precision at this level is approximately ±0.7 ppM at 1σ. The method was applied to the analysis of sodium sampled from the mass transfer loops. Hydrogen was found

in the loop sodium at concentrations of about 5 ppM but no correlation was found with the multibreak phenomena observed in plugging indicator runs performed on the loops. The method for sampling and analyzing the argon cover gas protecting the sodium in the loops for impurities is presented. Hydrogen, nitrogen, and an occasional trace of carbon-containing gases were observed in the cover gas.
Author (NSA)

N66-26482# Battelle-Northwest, Richland, Wash. Chemical Research Section.
ELECTROCHEMISTRY OF PLUTONIUM (III) IN MOLTEN ALKALI CHLORIDES
D. A. Nissen Nov. 1965 8 p refs
(Contract AT(45-1)-1830)
(BNWL-158) CFSTI: HC $1.00/MF $0.50

Chronopotentiometric and cyclic voltametric techniques were used to study the electrochemical reduction of Pu(III) to the metal in molten chloride solutions, in particular, the eutectic LiCl/KCl system. A postulated mechanism for the cathodic reduction of Pu(III) in this melt system as well as information on its diffusion properties are presented. The results showed that Pu(III) exhibits dissimilar behavior as the temperature of the melt is changed. At 400°C a characteristic function, the $i_{0}\tau^{1/2}$ product, is invariant with current density. At higher temperatures this function changes as the current density changes. It would appear on this basis that at 400°C plutonium, possibly in the form of a complex molecule, undergoes direct reduction to the metal. At temperatures in excess of 400°C, and equilibrium apparently exists between two complex species of plutonium; and the rate of transformation from one form to another is the rate controlling step.
NSA

N66-26488# Hercules Powder Co., Wilmington, Del. Research Center.
A STUDY OF THE ELECTRONIC CONFIGURATION AND BEHAVIOR OF THE $-NF_2$ GROUP Third Annual Report, Mar. 1, 1965–Feb. 28, 1966
Alan D. Craig and Alfred A. Albert 15 Apr. 1966 83 p refs
(Contract DA-31-124-ARO(D)-62; ARPA Order 402)
(HRC-66-1; AD-630945) CFSTI: HC $8.60/MF $0.75

Contents: Infrared spectroscopy of N–F compounds (methyldifluoramine, perfluoromethyl difluoramine, perfluoro-1,3,5-trieza cyclohexane); Electrochemistry of N–F compounds; The chemistry of NF (generation of NF by the reaction of HNF_2 with alkali metal fluorides, generation of NF by the reaction of HNF_2 with amines, reaction of HNF_2 with anionic bases); Synthesis of aromatic difluoramines; dipole moments of N–F compounds.
TAB

N66-26525# Aeronutronic, Newport Beach, Calif.
ABSORPTION BY CO_2 BETWEEN 8000 AND 10,000 CM^{-1} (1–1.25 MICRON REGION)
Darrell E. Burch, David A. Gryvnak, and Richard R. Patty 8 Aug. 1965 37 p refs
(Contract Nonr-3560(00); ARPA Order 273)
(U-3200; AD-626316) CFSTI: HC $2.00/MF $0.50

The absorption by CO_2 in the 9300 to 9650/cm region and 8000 to 8325/cm region was studied. Spectra were obtained for four samples of CO_2 in the 1.0 micron region at a pressure of 2.5 atmospheres and path lengths up to 933 meters. Spectra were obtained for ten samples of CO_2 in the 1.2 micron region at pressures as high as 15 atmospheres for path lengths up to 32.8 meters and pressures as high as 2.50 atmospheres for path lengths up to 933 meters. The strengths of the important bands and the half-widths of several lines have been measured. Tables of transmittance versus wave number are included for both regions as well as photographs of most of the spectra. Also presented are talbes of the integrated absorptance versus wavelength for both regions.
Author (TAB)

N66-26527# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTROLYTIC SILICONIZING OF MOLYBDENUM FROM FUSED SALTS
Ye. N. Shchetnikov, G. I. Belyayeva et al 13 Jan. 1966 13 p refs Transl. into ENGLISH from Zh. Prikl. Khim. (Moscow), v. 38, no. 1, 1965 p 197–201
(FTD-TT-65-1454/1+2+4; AD-627006) CFSTI: HC $1.00/MF $0.50

A mode of operation was developed for electrolytical siliconizing of molybdenum in a fusion: temperature 1100°C, density of current 0.3 amp/sq. cm, and time 4 to 6 hours. A compact smooth coating was thus obtained on the molybdenum which consisted of disilicide of molybdenum $MoSi_2$. An electrolytic coating of a thickness of 50 microns assures protection of the molybdenum against oxidation at a temperature of 1600°C for 7 to 10 hours.
Author (TAB)

N66-26575# Space-General Corp., Los Angeles, Calif. Artificial Biosystems Lab.
RESEARCH AND DEVELOPMENT PROGRAM ON AN ELECTROCHEMICAL ADAPTIVE SYSTEM FOR PATTERN RECOGNITION Quarterly Progress Report
Jan. 1966 10 p ref
(Contract NOw-65-0470-d)
(QPR-3; AD-629896) CFSTI: HC $1.60/MF $0.50

EXCITATION OF PASSIVE IRON SURFACE BY HEATING: A hypothesis is proposed that the passive iron film illuminated in 50–60% HNO_3 is being disrupted by the intense heating at the surface occasioned from the ruby laser and that results similar to energy densities of 50,000 watts/sq cm over a period of about 0.5 msec would be obtained over a broad range of incident wavelengths. The hope is that with a strength vs. duration excitation curve there will result data for designing a scanning image system capable of converting image patterns into parallel travelling patterns of electrochemical excitation in a manner reminiscent of the human eye and retina. SEARCH FOR RESONANCES IN THE PASSIVE SURFACE LAYER ON IRON IN NITRIC ACID: Molecular or other resonances are sought by using subthreshold illumination. A system of optical filters and/or monochromator with various inherent light sources will be used as well as a light chopper operating in the range of 1 to 100 cps, and a synchronous or narrow-band-tuned voltage detector circuit.
TAB

N66-26586# Dow Chemical Co., Midland, Mich. Metals Dept.
ANALYTICAL METHODS FOR IMPURITIES IN CESIUM METAL Final Report, 1 Jul. 1963–25 May 1964
O. V. Anders, H. H. Gill, W. R. Kramer, R. J. Moolenaar, V. A. Stenger et al [1964] 107 p refs
(Contract AF 33(657)-11209)
(AD-607272) CFSTI: HC $4.00/MF $0.75

Methods were developed and tested for the determination of oxygen, nitrogen, and carbon in cesium metal, in concentrations of from less than 10 to more than 300 parts per

million. In general the methods appear to be free from interferences. Oxygen is the only impurity likely to be found in more than extremely small traces in high quality cesium metal. The determination of oxygen can be carried out by the nondestructive neutron activation method, newly developed to give sufficient sensitivity, or by a new modification of the butyl bromide method designed to improve the accuracy. Previously the latter procedure gave low results, demonstrated in the present work to have been caused by a reaction between cesium oxide and butyl bromide. The methods developed for nitrogen and carbon permit identification of the forms in which these elements are most likely to occur, even though their concentrations are in the order of only 5 ppm. Author (TAB)

N66-26590# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.

DETERMINATION OF FREE TUNGSTEN IN TUNGSTEN SILICIDE (WSi_2) Technical Report, Feb.-Jun. 1965

Ken F. Sugawara Aug. 1965 23 p refs

(AFML-TR-65-248; AD-626685) CFSTI: HC $1.00/MF $0.50

The primary concern was to determine whether hydrogen peroxide solution (30%) could selectively and quantitatively separate free tungsten from WSi_2. The recovery experiments proved that quantitative recoveries from spiked samples by the recommended procedure were possible. When hydrogen peroxide was placed in contact with tungsten silicide at 60–70° C for 1 to 4 hr in order to study its reactance with the silicide, the results indicated that the concentration of tungsten in the extract attained a maximum value within one hour and remained essentially constant thereafter. The silicon content in the hydrogen peroxide fraction was determined experimentally by applying the spectrophotometric silicomolybdate (yellow) procedure. Since hydrogen peroxide seriously interfered in the method by intensifying the yellow color, a method was devised to eliminate this source of interference. If a material balance could be determined for each sample with sufficient accuracy and precision, important conclusions could be drawn with regard to the homogeneity of the sample as well as lend support to the validity of the method. The material balance study was greatly dependent upon the analysis of the WSi_2 residue following the extraction of free tungsten with hydrogen peroxide. TAB

N66-26649*# Unified Science Associates, Inc., Pasadena, Calif.

GASEOUS ELECTROLYTES FOR BATTERIES AND FUEL CELLS Third Quarterly Report, 21 Feb.-20 May 1965

S. Naiditch [1965] 50 p refs

(Contract NAS7-326)

(NASA-CR-75108) CFSTI: HC $2.00/MF $0.50 CSCL 07D

The objective of this program is to investigate the electrochemistry of dense gaseous solutions. Ammonia has been chosen as the solvent because of its low critical temperature and pressure and because it can be studied in glass cells since, unlike water, it does not dissolve glass under supercritical conditions. Author

N66-26658*# Brigham Young Univ., Provo, Utah. Dept. of Chemistry.

STUDIES OF REACTION GEOMETRY IN OXIDATION AND REDUCTION OF THE ALKALINE SILVER ELECTRODE

Eliot A. Butler Apr. 1961 42 p refs Prepared for JPL

(Contracts NAS7-100; JPL-951157)

(NASA-CR-75126) CFSTI: HC $2.00/MF $0.50 CSCL 07D

The major areas of research conducted on the oxidation and reduction of silver electrodes are reported. The oxidation of sintered electrodes at constant potential is described. The procedures used, the current–time curves obtained, and the effects of soaking the plates are discussed. The charge characteristics of the electrodes at constant current were investigated. The effects of surface area on the oxidation of the silver electrodes and the estimation of the surface area are included. Research was also conducted on the difference of surface potential in the oxidation of silver electrodes at constant current, and measurements were made of the differences in potential at the center and edge. The experimental results showed relationships between the potential gradient over the electrode surface and the following experimental variables: electrode configuration, current density, oxidation or reduction reaction, thickness of the oxide layer, and position of the sensing electrode relative to the test electrode. Graphs and photographs of the electrodes are presented for the experiments. N.E.N.

N66-26663*# National Bureau of Standards, Washington, D. C.

ELECTRON BEAM ELECTROLYSIS Second Quarterly Status Report, Feb. 15–May 15, 1966

Abner Brenner and John Sligh 1 Jun. 1966 10 p

(NASA Order R-09)

(NASA-CR-75146; NBS-9331) CFSTI: HC $1.00/MF $0.50 CSCL 07D

Difficulties encountered in attempting to apply the electron beam technique to the electrolysis of solid salts and ceramics are discussed. Electrical leakage between the heated tungsten filament and the anode lead was remedied by placing a ceramic tube over the lead-wire to the point where it contacted the electrolyzable material. Good specimens of a salt were obtained by casting the molten salt into an evaporating dish lined with a thin sheet of metal and allowing the salt to cool slowly. A method of heating ceramics to higher temperatures is described. Problems with arcing through, and the connection of the electrolyte with the anode lead are mentioned. N.E.N.

N66-26709# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

MIGRATION OF LIQUID INCLUSIONS IN SINGLE ICE CRYSTALS

P. Hoekstra, T. E. Osterkamp, and W. F. Weeks Dec. 1965 15 p refs

(CRREL-RR-183; AD-630978) CFSTI: HC $1.00/MF $0.50

The migration of brine pockets of KCl and NaCl under the influence of a temperature gradient was investigated in single ice crystals. The observed migration velocities are compared with velocities calculated from a simple diffusion model using the data on electrolytic solutions available in the literature. Although the relative movements of KCl and NaCl pockets were consistent with the diffusion theory, the observed velocities were always less than the calculated. Neither the direction of the gravitational field nor the crystallographic orientation of the host crystal significantly influenced the rate of migration. It was also shown that the migration of solid KCl particles occurs at temperatures below the eutectic point. Two mechanisms are proposed that would impede the mechanical differentiation of salts that crystallize at high temperatures relative to salts that remain in the brine of sea ice. These mechanisms explain recent field observations that the SO_4/Cl ratio of sea ice does not increase with the age of the ice. Author (TAB)

N66-26719# Glasgow Univ. (Scotland). Dept. of Chemistry.
STUDIES IN RING EXPANSION
G. L. Buchanan 31 Dec. 1964 35 p refs
(Grant AF-EOAR-63-36)
(SR-2; AD-628733) CFSTI: HC $2.00/MF $0.50

In contrast to an enolizable dimedone derivative, the non-enolizable 2-methyl-2-(2'-benzoyl ethyl)-dimedone was cyclised to 1-methyl-4-phenyl bicyclo (3.3.1)non-3-en-8.9-dione. The infrared spectrum of this and other non-enolizable β-diketones shows a split carbonyl band. This phenomenon was investigated. A new cycloheptene synthesis previously reported was applied to the synthesis of a compound related to the alkaloid colchicine. Author (TAB)

N66-26723# AeroChem Research Labs., Inc., Princeton, N. J.
KINETIC AND AERODYNAMIC ASPECTS OF THE OXIDATION OF MATERIALS BY PARTIALLY DISSOCIATED GASES Final Report, 15 Nov. 1962–14 Nov. 1965
Daniel E. Rosner and H. Donald Allendorf 3 Dec. 1965 27 p refs
(Contract AF 49(638)-1195)
(AeroChem-TP-124; AFOSR-66-0146; AD-628515) CFSTI: HC $2.60/MF $0.50

A synopsis is presented of the most significant results of a three-year research program carried out on the oxidation kinetics of refractory materials in dissociated gases. Microwave-discharge fast flow system techniques, coupled with electrical resistance heating and monitoring of the reacting specimens were used throughout. Experimental results are included for the attack of (a) polycrystalline molybdenum, tungsten, graphite, iridium and vitreous boron by atomic oxygen, (b) polycrystalline molybdenum and nickel by atomic chlorine, and (c) polycrystalline molybdenum by hydroxyl radicals. Reactant (O, Cl, and OH) partial pressures were of the order of 10^{-3} to 5×10^{-2} torr and surface temperatures were within the range 400 to 2600°K. A chronological list is provided of the seven publications and eleven reports describing these results and the underlying methods in greater detail. Author (TAB)

N66-26759*# Tyco Labs., Inc., Waltham, Mass.
DEVELOPMENT OF CATHODIC ELECTROCATALYSTS FOR USE IN LOW TEMPERATURE H_2/O_2 FUEL CELLS WITH AN ALKALINE ELECTROLYTE Third Quarterly Report, Jan. 1–Mar. 31, 1966
J. Giner, A. C. Makrides, and R. J. Jasinski [1966] 102 p
(Contract NASw-1233)
(NASA-CR-75199) CFSTI: HC $4.00/MF $0.75 CSCL 07D

A variety of metals; alloys; intermetallics; refractory metal compounds; and dispersed metals, alloys, and carbides were tested for corrosion resistance and activity as oxygen electrodes in potassium hydroxide at 75°C as part of an effort to improve the over-all efficiency of hydrogen–oxygen fuel cells. The preparations of specimens as solid ingots, cones, or as dispersed powders are outlined. Both rotating disk and floating electrode assemblies were used for the testing. Current-potential curves were measured for the one piece ingot type specimens. Of the elements tested, manganese showed activity for the reduction of O_2 above +800 mv. In general the performances of electrodes prepared directly from platinum blacks were inferior to commercial electrodes; but a porous silver electrode which was constructed proved superior in performance at high potentials (925mv–975mv) to the best of the commercial platinum electrodes. Severe corrosion was observed in all cases where borides, and silicides of the group IVB, VB, and VIB were tested. TiN showed significant activity for the reduction of O_2, being more active and more corrosion resistant than titanium metal. Current-potential curves obtained from the various tests are presented. L.S.

N66-26800# Argonne National Lab., Ill.
CRITICAL TEMPERATURES AND DENSITIES OF THE ALKALI METALS
Ira G. Dillon (Tuskegee Inst.), P. A. Nelson, and B. S. Swanson (Illinois Inst. of Tech.) Aug. 1965 67 p refs
(Contract W-31-109-ENG-38)
(ANL-7025) CFSTI: HC $3.00/MF $0.75

The results showed that the alkali metals deviate somewhat from the "law of corresponding states" based on nonmetallic substances. Also, the behavior of alkali metals was found to be somewhat different from that of mercury in that the shape of the density vs temperature curves is different and the entropy of vaporization is lower than that of mercury at reduced temperatures above 0.5. NSA

N66-26843# Thiokol Chemical Corp., Denville, N. J. Reaction Motors Div.
CARBORANE-SILOXANE ELASTOMERS Fourth Quarterly Report, 19 Nov. 1965–18 Feb. 1966
Joseph Green [1966] 22 p
(Contract DA-11-070-AMC-852(W))
(RMD-5065-Q4; AD-629891) CFSTI: HC $2.60/MF $0.50

The preparation of dicarboranyl alkanes by carboranylation of diacetylenic compounds and by alkylation of metallo carborane compounds was investigated. o-Carborane derivatives of such compounds were prepared by carboranylation of acetylenic compounds. Alkylation reactions yielded o-carborane exocycles and m-carborane low polymers. A monomer, bis(1-chlorodimethylsilyl-o-carboran-2-yl) propane was prepared and its thermal isomerization to the m-carborane derivative was attempted. Author (TAB)

N66-26868*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMMUNOADSORBENTS: PREPARATION AND USE OF CELLULOSE DERIVATIVES
Dan H. Campbell and Norman Weliky 1 May 1966 22 p refs
(Contract NAS7-100)
(NASA-CR-75272; JPL-TR-32-900) CFSTI: HC $1.00/MF $0.50 CSCL 07C

Chemicals, biochemicals, and biological materials that combine or complex specifically with insoluble substances can be isolated from mixtures by combination with these insoluble substances followed by dissociation under conditions that do not significantly alter the properties of interest of the desired materials. Antibodies can be isolated from the blood by directly linking these foreign macromolecules (antigens), or small portions of them (haptens), by chemical bonds to insoluble cellulose derivatives and using these insoluble substances (immunoadsorbents) to complex with, and remove antibodies from, the other components of blood serum or plasma. Methods are described in detail for performing these operations, and precautions are discussed for avoiding difficulties in applying these methods to different adsorbents and different antigen–antibody systems. Many antibodies can be isolated in greater than 90% yield and purity. Author

N66-26877*# General Dynamics Corp., Groton, Conn. Chemistry and Chemical Engineering Section.
THE SYNTHESIS AND UTILIZATION OF LOW MOLECULAR WEIGHT OZONIDES FOR AIR REVITALIZATION PURPOSES Interim Report, 14 Aug. 1964–14 Oct. 1965
A. W. Petrocelli and A. Capotosto, Jr. 14 Nov. 1965 87 p refs
(Contract NASw-559)
(NASA-CR-75281; U413-65-204) CFSTI: HC $3.00/MF $0.75 CSCL 07B

The synthesis and characterization of alkali and alkaline earth superoxides and ozonides has been continued. Various reaction schemes have been investigated in an effort to synthesize high-purity samples of calcium superoxide. Samples containing 40–60% calcium superoxide were consistently obtained from the reaction of aqueous hydrogen peroxide with solid calcium hydroxide which has been discussed in detail. The reaction of calcium hydroxide with water vapor has been characterized and its stoichiometry determined by the kinetic data obtained. Carbon dioxide absorption studies with sodium and calcium superoxides have been carried out and the observed respiratory quotients and reaction mechanisms have been discussed. Magnetic susceptibility measurements for potassium ozonide and superoxide, as well as calcium superoxide, have been obtained. Author

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N66-25393# Institut Franco-Allemand de Recherches, St. Louis (France).
INVESTIGATION OF A GAS DISCHARGE PRODUCED BY MICROWAVES AND BURNING FREELY IN SPACE [UNTERSUCHUNG EINER DURCH MIKROWELLEN ERZEUGTEN, FREI IM RAUM BRENNENDEN GASENTLADUNG]
M. Schwertl 22 Sep. 1964 45 p In GERMAN
(Contract T-458-I-206)
(ISL-T-32/64) CFSTI: HC $2.00/MF $0.50

The experimental arrangement of a discharge of gas contained under reproducible pressure in a glass receptacle, and set off by concentrated 3.2-cm waves produced by a pulsated X-band generator, is described. The discharge is examined as to spatial expansion, pressure range of burning, and ionization process. The electrical field strength and the power output within the discharge area are calculated. An arrangement for measuring temperature increases of the gas in the discharge area is given. Mean gas temperature was up to 250°C.
Transl. by K.W.

N66-25394# Institut Franco-Allemand de Recherches, St. Louis (France).
STUDY OF PROJECTILE MOVEMENT IN THE TUBE WITH HELP FROM MICROWAVES AND RADIOGRAPH FLASHES IN CONNECTION WITH COMPARABLE PIEZOELECTRIC GAS PRESSURE MEASUREMENTS [UNTERSUCHUNGEN DER GESCHOSSBEWEGUNG IM LAUF MIT HILFE VON MIKROWELLEN UND RONTGENBLITZAUFNAHMEN IN VERBINDUNG MIT VERGLEICHENDEN PIEZOELEKTRISCHEN GASDRUCKMESSUNGEN]
H. Wüst and G. Schultze 14 Dec. 1964 88 p refs In GERMAN
(Contract T-451-I-206)
(ISL-8/64) CFSTI: HC $3.00/MF $0.75

Measuring by radiograph flashes and Doppler radar was combined and additionally coordinated with piezoelectric measurement of the gas pressure curve to determine the projectile movement in the tube as completely as possible. A 2-cm tube with smooth bore was used. The kinematic progress of the projectile was primarily measured. Exact time–location of the projectile was given by the radiograph flash, the radar established the interconnection of distance–time–velocity of the projectile. Microwaves used initially were $\lambda = 3.0$ cm, then $\lambda = 8$ mm, followed by concurrent measuring with both wave lengths, which proved best. Kinematic results and gas pressure measurements were mathematically compared.
Transl. by K.W.

N66-25422# Radio and Space Research Station, Slough (England).
OPTICAL OBSERVATIONS RECEIVED BY THE PREDICTION SERVICE FOR THE MONTH OF NOVEMBER 1965. SUPPLEMENTARY OBSERVATIONS FOR THE MONTHS OF NOVEMBER 1964 AND MARCH, APRIL, MAY, JULY, AUGUST, SEPTEMBER AND OCTOBER 1965
[1966] 146 p
CFSTI: HC $4.00/MF $1.00

The observations on satellites and unidentified objects are presented. The tables include universal time, right ascension, and declination data. N.E.N.

N66-25453# Japan Broadcasting Corp., Tokyo. Technical Research Labs.
VOICE-OVER LIP SYNCHRONIZATION DEVICE
Feb. 1966 11 p *Its* Serial No. 68
(D-2) CFSTI: HC $1.00/MF $0.50

This paper describes a voice-over lip synchronization device which was experimentally developed for the purpose of rationalizing the sound rerecording process for foreign films. The device is designed to deliver instructions to rerecorders for the start and finish of rerecording scenarios in the form of optical intermittent waveforms in order to make the lip motions of the characters in the picture coincide with the scenarios. This device thereby allows the stand-in speakers to concentrate on the performance of rerecording with ample psychological reserve. R.N.A.

N66-25508# Pennsylvania State Univ., University Park. Ordnance Research Lab.
TRANSIENT WAVE PROPAGATION IN AN EXPONENTIAL MEDIUM
Michael A. Gray (M.S. Thesis) 24 Feb. 1966 56 p refs
(Contract NOw-65-0123-d)
(TM-633.2721-03; AD-629897) CFSTI: HC $5.60/MF $0.50

Electromagnetic wave propagation in a medium with an exponentially increasing charge density is studied. Both

transmitted and reflected fields are found in the case of plane, monochromatic waves. The use of the bilateral Laplace transform allows the transforms of the transmitted and reflected fields to be found in the case of a stepfunction excitation moving with velocity c_0 previous to entering the exponential medium. The reflected and transmitted fields are found explicitly when the Bessel functions obtained as solutions can be expanded asymptotically for small argument.

Author (TAB)

N66-25519# Navy Underwater Sound Lab., New London, Conn.

THE NEAR FIELDS OF SUBSURFACE ELECTRIC DIPOLE ANTENNAS

Peter R. Bannister and William C. Hart 4 Mar. 1966 17 p refs (USL-728; AD-629878) CFSTI: HC $1.60/MF $0.50

The electric and magnetic field components produced by subsurface ($h \leq 0$) vertical and horizontal electric dipole antennas are presented for the near-field range (ρ comparable to λ_{air}) with $z \geq 0$. The derived field-component expressions reduce to previously derived results when $z=h=0$. This range has been considered by many writers, but with the restriction that $\rho >> z$. In this report, the authors evaluate the previously underived (to the authors' knowledge) components that are valid for any height z (neglecting ionospheric effects).

Author (TAB)

N66-25520# Navy Underwater Sound Lab., New London, Conn.

THE NEAR FIELDS OF SUBSURFACE MAGNETIC DIPOLE ANTENNAS

William C. Hart and Peter R. Bannister 7 Mar. 1966 15 p refs (USL-729; AD-629916) CFSTI: HC $1.60/MF $0.50

The electric and magnetic field components produced by subsurface ($h \leq 0$) vertical and horizontal magnetic dipoles are presented for the near-field range (ρ comparable to λ_{air}) with $z \geq 0$. This range has been considered by many writers, but with the restriction that $\rho >> z$. In this report, the authors evaluate the previously underived (to the authors' knowledge) components that are valid for any height z (neglecting ionospheric effects).

Author (TAB)

N66-25521# Lincoln Lab., Mass. Inst. of Tech., Lexington.

A SUMMARY, BY ILLUSTRATIONS, OF LEAST SQUARES FILTERS WITH CONSTRAINTS

Jon F. Claerbout 31 Jan. 1966 18 p refs (Contract AF 19(628)-5167; ARPA Order 512) (TN-1966-7; ESD-TDR-66-22; AD-629968) CFSTI: HC $1.60/MF $0.50

Several methods of combining a number of time series into a single series are discussed. They are all individual filtering followed by summation and are somewhat like Wiener filtering in that signal information is given in the form of various linear constraints on the filter coefficients rather than being given as a signal correlation function. The formulas are worked out explicitly for the case of two time series and three filter points, and presented in such a way as to make generalization clear.

Author (TAB)

N66-25555*# TRW Systems, Redondo Beach, Calif.

EVALUATION OF THE USE OF POWERED FLIGHT TRACKING AND TELEMETRY DATA IN LUNAR ORBIT DIFFERENTIAL CORRECTION PROCEDURES

D. H. Lewis [1966] 45 p refs (Contract NAS1-4605-3) (NASA-CR-66064) CFSTI: HC $2.00/MF $0.50 CSCL 09F

The main deboost required to transfer a spacecraft from a hyperbolic approach orbit to an intermediate elliptical selenocentric orbit was used to represent the powered flight maneuver. Simulated range and range-rate tracking data were assumed to be taken from Goldston, Woomer, and Madrid at one set per minute; telemetry data consisted of the body components of thrust acceleration. Uncertainties were considered in the thrust orientation angles; the accelerometer scale factor; and the velocity cutoff resolution. Finally, the state vector covariance matrix was computed using tracking from the second midcourse to initiation of the main deboost. It was found that the use of these data reduced the state vector uncertainties to the level that existed before the maneuver. Also, it was found, that when taken individually, tracking is more useful than telemetry data. State vector uncertainties using the former were about 1/5 of those which exist when no powered flight data is used; telemetry data reduced the values only by 1/2. D.T.

N66-25558*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

EXPERIMENTAL MEASUREMENT OF OPTICAL ANGULAR DEVIATION CAUSED BY ATMOSPHERIC TURBULENCE AND REFRACTION

Robert L. Kurtz and James L. Hayes Washington, NASA, May 1966 60 p refs (NASA-TN-D-3439) CFSTI: HC $3.00/MF $0.50 CSCL 17H

Atmospheric turbulence causes the image of a stationary optical source to fluctuate in intensity and position. The amplitude and frequency of this random position fluctuation have been measured. Data were recorded over a period of approximately six months and over two different path lengths. The system and site are described. Data are analyzed and tabulated to show the amplitude of fluctuations in various meteorological conditions. A sample of these data is statistically analyzed to determine the limitations of an optical tracking system.

Author

N66-25559*# Motorola, Inc., Scottsdale, Ariz. Military Electronics Div.

INTEGRATED CIRCUIT APPLICATION TO APOLLO UDL Final Report

R. H. Herring 28 Jul. 1965 88 p *Its* Rept.-3030-1-10 (Contract NAS9-3458) (NASA-CR-65338) CFSTI: HC $3.00/MF $0.75 CSCL 09F

A monolithic integrated circuit decoder was designed, fabricated, and performance tested for the Apollo Up-Data-Link (UDL); and a complete UDL engineering model, incorporating the decoder, was built and tested. The package form factors were to be compatible with Apollo Block II packaging. The integrated circuit UDL consists of a sub-bit detector, and I/C decoder, an interface assembly, a voltage regulator, and a mounting base with internally contained wiring harness. With the complete integration of the decoder, and some miniaturization of the voltage regulator and sub-bit detector, it is noted that approximately 65% of the Apollo UDL electronic hardware has been integrated including all digital circuits. As a result, the following size, weight, and power reductions were achieved: size, from 560 to 214 cu in.; weight, from 16.2 to 5.6 pounds; and power, from 7.8 to 6.8 watts. D.T.

N66-25567# Joint Publications Research Service, Washington, D. C.
LONG-RANGE TROPOSPHERIC PROPAGATION MICROWAVES
B. A. Vvedenskiy et al 18 May 1966 446 p refs Transl. into ENGLISH of the book "Dal'neye Troposfernoye Rasprostraneniye Ul'trakorotkikh Radiovoln" Moscow, "Sovetskoye Radio" Publ. House, 1965 p 3-415
(JPRS-35585; TT-66-32020) CFSTI: $7.30

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N66-25574*# Radio Corp. of America, Moorestown, N. J. Missile and Surface Radar Div.
BURST TRANSMISSION OF PCM DATA STUDY Final Report
Mar. 1966 188 p
(Contract NAS9-4244)
(NASA-CR-65346) CFSTI: HC $5.00/MF $1.25 CSCL 09F

The feasibility of retransmitting pulse code modulated data from multiple asynchronous telemetry links in block, i.e., periodic burst, form was investigated. In order to establish the necessary capability to identify each individual parameter, burst techniques were studied which would be able to perform the following functions: (1) select pre-specified parameters and assemble blocks; (2) contiguously merge these blocks into an efficient format; (3) provide for the extraction of parameters from the format; (4) provide for periodic readout of parameters; and (5) provide a means for reestablishing the time of individual samples. The data block is defined as either containing all parameters selected from a single input link, or, simply, a grouping of parameters as received, in any order from any and all input links. In the first case the message would consist of the same number of blocks as there were input links and would be rather large; in the second, the block size would depend solely on the capacity of the communications circuit, but would usually be small in order to maintain a continuous flow of data. D.T.

N66-25580*# Melpar, Inc., Falls Church, Va.
THIN-FILM PERSONAL COMMUNICATIONS AND TELEMETRY SYSTEM (TFPCTS) Third Quarterly Report, 21 Jun.-21 Sep. 1965
Barry J. Weiner Oct. 1965 103 p refs
(Contract NAS9-3924)
(NASA-CR-65356) CFSTI: HC $4.00/MF $0.75 CSCL 09F

Practical techniques were developed for fabricating a thin film, high frequency, active triode. Optimization of the selected semiconductor materials, cadmium selenide, cadmium sulfide, cadmium telluride, and tellurium was continued. Work was also continued on a metal base transistor; attempts were made to form junctions, back to back, with reverse blocking direction. The diodes themselves underwent a thorough investigation of the operating mechanisms in order to design them for high frequency operation and varactor usage. The design approaches and circuit component requirements were studied for a TFPCTS. Preliminary requirements are presented and discussed. In addition, a study of circuit design is included. D.T.

N66-25621# RAND Corp., Santa Monica, Calif.
ADAPTIVE ROUTING TECHNIQUES FOR DISTRIBUTED COMMUNICATIONS SYSTEMS
B. W. Boehm and R. L. Mobley Feb. 1966 95 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4781-PR; AD-630271) CFSTI: HC $9.60/MF $0.75

A discussion is made of the operational characteristics of the various adaptive routing techniques. The memorandum shows that the techniques previously investigated are insufficient for the task, and investigates a number of promising alternatives. Among these are some stochastic techniques that use information on messages passing through the network to adjust the tables, and some deterministic techniques that use dynamic programming or graph-theoretic algorithms to recalculate changes in the tables from observed changes in the network. Each alternative has operational advantages for certain communications systems, and certain disadvantages for others. The appropriate techniques or combinations of techniques depend on several enumerated factors. The authors point out a number of research areas where further efforts in the analysis and simulation of such techniques will be useful in the design of future distributed communications systems. Author (TAB)

N66-25623*# Illinois Univ., Urbana. Antenna Lab.
AN ALTERNATIVE APPROACH TO THE SOLUTION OF A CLASS OF WIENER-HOPF AND RELATED PROBLEMS Technical Report No. 8

R. Mittra and C. P. Bates Feb. 1966 31 p refs Presented at the URSI EM Theory Symp., Delft, Netherlands *Its* Rept.-65-21 (Grant NsG-395; Contract AF 19(628)-3819) (NASA-CR-75265; ALR-65-21; AFCRL-65-919; AD-630011) CFSTI: HC $3.60/MF $0.50 CSCL 09C

A method is presented for solving a class of radiation and diffraction problems which have conventionally been formulated in terms of the Wiener-Hopf approach. The problem is formulated by representing the fields in terms of a modal expansion. The modal expansion for the field in the open regions is characterized by continuous eigenvalues and for the closed regions the fields are represented in terms of the discrete eigenvectors. Matching of the fields to the boundaries and across the aperture results in an equation which is solved by a technique developed in this article. The technique is an extension of the function-theoretic method necessitated by the field representation in the open regions inherent in the problems. The solution of an open-ended parallel plate waveguide is used to demonstrate the method. Applications to other geometries are indicated. Author (TAB)

N66-25630# Chalmers Univ. of Technology, Goteborg (Sweden).

THERMAL NOISE RADIATION FROM THE ATMOSPHERE

Torleiv Aa. Orhaug 1965 100 p refs *Its* Trans. No. 300 Avdel. Elektroteknik 77

CFSTI: HC $3.00/MF $0.75

Thermal noise radiation in the microwave region of the lower atmosphere is considered, and the theory of generating thermal noises in an absorbing medium is reviewed. An expression is evolved for the brightness temperature of the isothermal case. The elevation angle dependence for both the isothermal and plane-earth cases is given, and the corresponding antenna temperature is discussed. Atmospheric noise level resulting from oxygen and water vapor is discussed; and it is pointed out that the variation in atmospheric brightness temperature, both with time and location, is caused mainly by variations in total water vapor content along the line of sight. Brightness temperature from water vapor is expressed in terms of amount of precipitable water. M.W.R.

N66-25659# Radio and Space Research Station, Slough (England).

KINETHEODOLITE OBSERVATIONS OF SATELLITES RECEIVED BY THE PREDICTION SERVICE (SATELLITE ORBITS GROUP) FROM HERSTMONCEUX FOR APRIL, MAY AND JUNE 1964 AND FROM MALTA FOR OCTOBER AND NOVEMBER 1965

1966 95 p *Its* Issue No. 9

CFSTI: HC $3.00/MF $0.75

Kinetheodolitic observations of earth satellites are listed. The list identifies the satellite observed, the number and time of the observations, the apparent geographic altitude and azimuth, and the type and estimated quality of the observation. H.S.W.

N66-25682# RAND Corp., Santa Monica, Calif.

A COMPUTER SIMULATION OF ADAPTIVE ROUTING TECHNIQUES FOR DISTRIBUTED COMMUNICATIONS SYSTEMS

B. W. Boehm and R. L. Mobley Feb. 1966 42 p refs (Contract AF 49(638)-1700; Project RAND) (RM-4782-PR; AD-630301) CFSTI: HC $2.00/MF $0.50

Description of a computer model of a distributed communications system. It is written in FORTRAN IV and is designed to test various adaptive message routing techniques. The program simulates the progress of messages through the system and measures the effects of the routing techniques' adaptation to specified degrees of destruction of its links and nodes. A listing of the program is given, plus the pitfalls to avoid in developing similar programs. Author (TAB)

N66-25713*# National Aeronautics and Space Administration, Washington, D. C.

CHARACTERISTICS OF SHORTWAVE COMMUNICATION WITH SPACECRAFTS

F. I. Berbasov, T. S. Kerblay, Ye. M. Kovalevskaya, and L. N. Lyakhova *In its* Space Res. May 1966 p 295–304 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Study of the features of short wave communications with Vostok spacecrafts indicates that at altitudes below the maximum of the F2 layer, higher frequency waves may be propagated in addition to those radio waves reflected from the F2 layer itself. Sporadic ionization in the E layer and horizontal ionization gradients play an essential part in this additional wave propagation, and an attempt to measure these effects is considered satisfactory in view of limited knowledge on the subject. Experimental data emphasize the need to make allowances for various phenomena in the ionosphere when computing radio communications frequencies. Signal and gradient propagation are discussed. M.W.R.

N66-25714*# National Aeronautics and Space Administration, Washington, D. C.

RADIOWAVE PROPAGATION IN INTERPLANETARY AND CIRCUMSOLAR SPACE

M. A. Kolosov, O. I. Yakovlev, and A. I. Yefimov *In its* Space Res. May 1966 p 305–313 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Data are presented for radio wave propagation at 183.6 Mc frequency received from the Mars I spacecraft at distances up to 50,000 km. Additional information is obtained by radio emission from Taurus-A at a distance on the order of 300,000,000 km. It is suggested that spectrum change occurs when monochromatic radiowaves are propagated from such large distance. Maximum possible values and the mechanism for monochromatic radio wave attenuation in interplanetary space are discussed, and attention is given to radiowaves with a white spectrum in circumsolar space. M.W.R.

N66-25801# National Research Council of Canada, Ottawa (Ontario).

BULLETIN OF THE RADIO AND ELECTRICAL ENGINEERING DIVISION, NATIONAL RESEARCH COUNCIL OF CANADA, VOLUME 15, NO. 3, JULY-SEPTEMBER 1965

W. F. Chisholm, ed. Sep. 1965 56 p refs

CFSTI: HC $3.00/MF $0.50

Technology, instrumentation, and experiments in radio and electrical engineering are reported. Facilities for sounding rockets and measuring solar activity in the meter wavelength region are described. Instrumentation for radio frequency experiments and applications is mentioned. Among the research discussed are microwave attenuation measurement, auroral observations, fluorescence in anthracene single crystals, and elastic reflections of very slow electrons from single crystal surfaces. N.E.N.

N66-25831# Ohio State Univ. Research Foundation, Columbus.

PHASE ERROR ANALYSIS FOR AN ACTIVE ARRAY SYSTEM Interim Report

Charles H. Brenner Griffiss AFB, N. Y., RADC, Mar. 1966 38 p refs *Its* Rept.-1963-3
(Contract AF 30(602)-3601)
(RADC-TR-65-232, Vol. III; AD-630465) CFSTI: HC $2.00/MF $0.50

An active (transmitting and receiving) array operating at X-band using four 30-foot parabolic antennas is discussed. The active array system is designed to operate with both active and passive orbiting satellites as a target. Phasing information received from the target is used to control the phases of the transmitted signals such that they add coherently at the satellite. Thus the active array operates as a servo system with an inherent time delay equal to twice the propagation time delay from the satellite to the ground station. The optimum transfer function for the active array system, including the effects of this time delay, is determined for various input signals by using a Weiner-Hopf optimization technique. Performance of the system is evaluated for both deterministic and stochastic input signals. Various deterministic input signals are used to calculate the optimum transfer function. Then the mean square error (MSE) and integral square error (ISE) are evaluated for various combinations of deterministic inputs and transfer functions. Seven different power density spectra (PDS) are used to represent the stochastic input signals. Author (TAB)

N66-25837# Ohio State Univ. Research Foundation, Columbus.
ACTIVE ARRAY TECHNIQUE Interim Report
C. H. Brenner and J. E. Tourdot Griffiss AFB, N. Y., RADC, Feb. 1966 31 p refs *Its* Rept.-1963-2
(Contract AF 30(602)-3601)
(RADC-TR-65-232, Vol. I; AD-630472) CFSTI: HC $2.00/MF $0.50

Two possible means of accomplishing phase coherence of signals at some point in space are discussed. These signals are radiated from separate transmitters of an array. The methods discussed are 'beam tagging' and 'phase conjugation.' These methods are discussed as to implementation and their advantages and disadvantages presented. The discussion is aimed at describing the way an array may be used in a satellite communications link. Author (TAB)

N66-25839# Naval Air Development Center, Johnsville, Pa. Aero-Electronic Technology Dept.
MULTIPATH ENVIRONMENT SIMULATOR
F. P. Darreff 26 Jan. 1966 29 p refs
(NADC-AE-6525; AD-628871) CFSTI: HC $2.60/MF $0.50

The operation of a laboratory simulator which duplicates a one way propagation path between two airborne systems is described. An arbitrary input signal is modified to simulate a signal received in flight. The modified signal corresponds to a signal containing energy from a direct and a reflected path. Author (TAB)

N66-25846# Sperry Rand Research Center, Sudbury, Mass.
PERFORMANCE EVALUTION OF SPEECH PROCESSING DEVICES. II: THE ROLE OF INDIVIDUAL DIFFERENCES Scientific Report, 1 Mar.-30 Nov. 1965
William D. Voiers Dec. 1965 66 p refs
(Contract AF 19(628)-4987)
(SRRC-RR-65-115; AFCRL-66-24; AD-630428) CFSTI: HC $3.00/MF $0.75

The report treats three topics related to the phenomenon of individual differences in speech: (1) the effect upon speech intelligibility of the listener's familiarity with the speaker's voice; (2) the nature and number of elementary ways, or PAT's (perceived acoustic traits) in which voices are perceived to differ from each other; (3) the physical bases of perceived acoustic traits. Speech intelligibility as measured by the Diagnostic Rhyme Test was unaffected by the degree of the listener's familiarity with the speaker's voice, where the basis of familiarity was a maximum of three presentations of a two-minute sample of prose. A voice rating experiment, involving both mono-polar and bi-polar ratings scales failed to reveal any previously unidentified PAT's. A factor analysis of 22 physical and perceptual voice variables yielded results to indicate that the physical correlates of some PAT's may be qualitatively shifted under certain conditions of stimulus impoverishment. The physical bases of the PAT's, Pitch-Magnitude and Animation-Rate appear to be relatively stable under various conditions of stimulus impoverishment, but the physical bases of Loudness-Roughness and Clarity-Beauty may be drastically altered by frequency distortion and vocoderization. Author (TAB)

N66-25848# Polytechnic Inst. of Brooklyn, Farmingdale, N. Y. Dept. of Electrophysics.
LATERAL WAVES
Leopold B. Felsen 15 Nov. 1965 63 p refs
(Contract AF 19(628)-2357)
(PIBMRI-1303-65; AFCRL-65-889; AD-630144) CFSTI: HC $6.60/MF $0.75

When a radiator is located in a region wherein two or more wave types (1,2...) may propagate with different speeds, and when a boundary coupling these wave types is present, diffraction phenomena may arise which are describable in terms of lateral waves. A lateral wave is launched by that portion of the incident field of type 1, for example, which gives rise to a field of type 2 refracted parallel to the boundary and which in turn refracts into a field of type 1. The properties of lateral waves are reviewed in the transient and in the time-harmonic regimes. Concepts of wave coupling are emphasized, and general analytical features, as well as graphical procedures using refractive index diagrams, are described. Illustrative examples exhibit lateral waves on the interface between two homogeneous or inhomogeneous dielectrics, on a perfectly conducting plane immersed in an anisotropic and (or) compressible plasma, and also on a perfectly conducting half plane. The latter example shows how lateral waves may be diffracted by an edge discontinuity. Some relations between lateral waves, leaky waves, and spectral representations are also included. Author (TAB)

N66-25861# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
STUDY DIRECTED TOWARD OPTIMIZATION OF OPERATING PARAMETERS OF EMAC PROBE FOR THE REMOTE MEASUREMENT OF ATMOSPHERIC PARAMETERS Final Report
Clayton H. Allen and Stephen D. Weiner Sep. 1963 165 p refs *Its* Rept.-1056
(Contract AF 19(628)-2774)
(AFCRL-63-596; AD-629996) CFSTI: HC $16.10/MF $1.00

The concept of utilizing sound waves as reflectors for pulsed Doppler radar as a means for measuring wind velocity, turbulence, and air temperature has been examined theoretically. Any extension of the initial and successful, small scale experiments performed by Midwest Research Institute to a practical system for atmospheric probing is shown to require a change in the operating concept of the acoustic system. This

change involves the abandoning of the concept of coherent reflection reinforcement from a multiple wave train and the substitution of reflection from a single acoustic shock front with the introduction of coherent integration of the pulsed Doppler radar signal. A preliminary experimental approach to a practical system is proposed. Author (TAB)

N66-25865# Lincoln Lab., Mass. Inst. of Tech., Lexington.
HAYSTACK POINTING SYSTEM: PERIPHERAL PROGRAMS
John D. Drinan, ed. 17 Feb. 1966 189 p refs
(Contract AF 19(628)-5167)
(TN-1966-13; ESD-TDR-66-43; AD-630193) CFSTI: HC $18.50/MF $1.00

A set of eight non-real-time service programs was written in support of the Haystack Pointing System to facilitate system maintenance and updating. Peripheral functions afforded by this set of programs include: (1) format conversion and remote printing facility of the SPURT assembler printer outputs 210, 211 and 212; (2) magnetic tape dumping; (3) 'effective' punched card input to SPURT assembler; (4) Cal Comp plotting of system output; (5) punched card equivalents of Common Storage Allocation Tape; (6) automatic program loading with bootstrap tape generation facilities; (7) magnetic tape duplication; and (8) automatic updating of system tapes. Author (TAB)

N66-25898# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIO AND RADAR TECHNOLOGY AND ITS APPLICATION
K. M. Listov and K. N. Trofimov 12 Feb. 1965 487 p refs
Transl. into ENGLISH of the book "Radio i Radiolokatsionnaya Tekhnika i Ikh Primeneniye" Moscow, Voyennoye Izd. Minister. Oborony Soyuza, 1960 p 1-423
(FTD-MT-64-60; TT-65-61976; AD-613964) CFSTI: HC $8.00/MF $2.25

Contents: (1) A brief history of the origin and development of military radio communications; (2) General concepts of radio communications and a brief outline of radio engineering; (3) Properties of radio waves and the nature of their propagation; (4) Role of radio communication in modern combat; (5) Military radio communications; (6) Radio communications facilities and radio navigation of aviation; (7) Means of radio communications of the navy; (8) Application of television in military affairs; (9) A short history of the development of radar in the USSR; (10) Physical bases of radar; (11) Infrared technology; (12) Radar facilities for antiaircraft defense; (13) Radar and infrared facilities of the navy; (14) Radar armament of the air force; (15) Radar and infrared facilities of land forces; (16) Equipment for radar target identification; (17) Meteorological radar stations; (18) Facilities for combating radar. TAB

N66-25903# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INFLUENCE OF THE EARTH'S SURFACE ON RADAR
Nathaniel I. Durlach 18 Jan. 1965 77 p refs
(Contracts AF 19(628)-500; AF 19(628)-5167)
(TR-373; ESD-TDR-65-32; AD-627635) CFSTI: HC $3.00/MF $0.75

This report provides radar designers with background information on how the idealized free-space radar theory must be modified to take account of reflections from the earth's surface. It is primarily concerned with problems that arise in designing systems that are airborne and contains discussions of the following topics: effects of reflections from the earth on the signal received from an elevated target, implications of these effects for detection and parameter estimation, effects of surface roughness, techniques for the reduction of clutter, scattering from the ocean, and spherical-earth geometry. Author (TAB)

N66-25917# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ORBITAL ELEMENTS FROM DOPPLER TRACKING OF THREE SATELLITES
Robert R. Newton Nov. 1963 17 p
(Contract NOw-62-0604-c)
(TG-539; AD-630034) CFSTI: HC $1.60/MF $0.50

The orbital elements resulting from this tracking are of research interest in two different ways. First, their secular and long-term periodic perturbations can be analyzed to yield equations of condition connecting the zonal harmonics in the Earth's gravitational field. Second, because of the unique nature of the radio signals from these satellites, they have been used in studies of radio propagation through the ionosphere and troposphere, and in studies of the reflections of radio signals from the Earth's surface. The paper presents tables of orbital elements of these satellites which are adequate for either of these types of research. Author (TAB)

N66-25937# Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va.
MICROWAVE POINTING VARIATIONS AND ANGLE MEASUREMENTS
Peter J. Cervarich Jan. 1966 47 p refs
(Rept.-26-TR; AD-630249) CFSTI: HC $4.60/MF $0.50

Tests were performed to obtain simultaneous data pertaining to the long-term and short-term signal angle-of-arrival variations at 9.4, 18.8, and 35 Gc/s frequencies being transmitted over the same path as detected by three existing systems; and to perform angle determinations using the 35 Gc/s system. Analyses of data indicate that the short-term variations are greater with the 35 Gc/s system than with the 18.8 Gc/s system, but are more symmetrical about the long-term mean; that the long-term variations are shortest with the 35 Gc/s system; that both short-term and long-term variations with the 9.4 Gc/s system are much greater than the other systems; and that angle determinations within a few arc seconds are achievable when the 35 Gc/s interferometer is used. Some correlation with temperature is indicated, and an explanation for the cause of short-term effects and the relative influence of long-term variations on the angle measurements is discussed. No explanation is offered for the apparent reduced sensitivity of the higher frequency systems to either long-term variations or atmospheric parameters. Author (TAB)

N66-26050# Weapons Research Establishment (Australia).
AN "IN BAND" EVENT TIMING SYSTEM WITH MINIMUM DELAY, FOR USE WITH TYPE 465 TELEMETRY
C. J. Tatum and A. M. Forbes Jun. 1965 16 p
(WRE-TM-ISD-100) CFSTI: HC $1.00/MF $0.50

Design data is given, based on laboratory measurements, for a single-event telemetry system for use with type 465 telemetry. The system is designed for minimum delay in real-time readout, a delay time of approximately 100 μsec., excluding transmission time, being achievable. The minimum spacing between events is 200 μsec. Since the event information is contained wholly within the standard sub-carrier band, it can

be recorded by the standard magnetic tape recording systems used for type 465 telemetry, without any modifications to the tape recording equipment. Author

N66-26071# British Broadcasting Corp., Kingswood (England). Engineering Div.

TROPOSPHERIC PROPAGATION MEASUREMENTS OVER MIXED LAND AND SEA PATHS AT 560 MC/S

E. Sofaer and J. W. Stark Sep. 1965 24 p refs (K-180)

Field strength measurements of a transmission at 560 Mc/s were carried out over mixed land and sea paths at distances ranging from 198 km to 356 km. The results show that the attenuation, relative to an all-sea path, introduced by sections of land at the end of the path increases with distance from the coast. A method of estimating the attenuation due to the presence of land in the path is proposed. Author

N66-26097# Joint Publications Research Service, Washington, D. C.

THE BASIC INDICES OF A CONTINUOUS-SIGNAL TELETRANSMISSION SYSTEM FOR DISPERSED OBJECTS

L. I. Dovbeta *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 62–64 refs (See N66-26086 14-14) CFSTI: $6.00

A multichannel radio-telemetering system for dispersed and shifting objects is described. A pulse-time modulation is used for the signal transmission, with amplitude modulation of the carrier in the radio channel. The system consists of three sections and time-division multiplexing covers up to 20 channels for each section. Signal transmission proceeds on a separate transmission frequency. The frequency bandwidth occupied in a communication link by one section is about 5 millicycles per second. It is reported that the amplitude of the input signal ranges from a high of 1.6 volts to a low of 0.005 volts, and that the fundamental error of the teletransmission caused by the instability of the transmission factors of the telemetering channel does not exceed 4.5% and the complementary error does not exceed 5%. H.S.W.

N66-26116# Joint Publications Research Service, Washington, D. C.

THE APPLICATION OF ERROR-CORRECTING CODES FOR INCREASING THE INTERFERENCE IMMUNITY AND RELIABILITY OF A TELEMECHANICAL SYSTEM

B. Y. Souetov *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 174–181 refs (See N66-26086 14-14) CFSTI: $6.00

The interference immunity and reliability of a telemechanical system, when using non-binary codes correcting the single errors, is examined. Relationships are given for determining the probability of receiving a message correctly when interference action from a pulsed character is present. Author

N66-26125*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

DESCRIPTION AND ANALYSIS OF 890-MHz NOISE-MEASURING EQUIPMENT

K. W. Biber and A. C. Whittlesey 31 Mar. 1966 20 p refs (Contract NAS7-100)

(NASA-CR-74888; JPL-TR-32-898) CFSTI: HC $1.00/MF $0.50

This report describes a narrow-band, low-noise system used with the Ranger spacecraft system for measuring noise at a frequency of 890.046 MHz ±50 kHz. It includes a description of the equipment and its operation, a mathematical evaluation of system performance capabilities and of particular circuit constraints upon system operation, and a procedure for system calibration and operation. Author

N66-26180# Joint Publications Research Service, Washington, D. C.

THE THEORY OF RADIOCOMMUNICATION CHANNELS WITH RANDOM VARYING PARAMETERS

V. I. Siforov 26 May 1966 34 p refs Transl. into ENGLISH from Acta Tech. Acad. Scientiarum Hung. (Budapest), v. 39, no. 1–2, 1962 p 135–162

(JPRS-35719; TT-66-32154) CFSTI: $2.00

This article presents the results of an investigation on channel capacity in radio communication with multibeam wave propagation which was conducted to develop a theory of interference stability and channel capacity in the case of random variable parameters and, specifically, to formulate the theory for application to multipath communication channels. Communication channels, their classification and parameters, and channel capacity with slowly varying parameters are discussed. The conditions which a multipath channel with random variable parameters must satisfy in order to attain a very high capacity when the level of additive noises is low are determined. Also included is an examination of the problem of determining the lower limit of channel capacity in the case of a single path communication channel in which the wave absorption is a random function of time, and where additive fluctuation noises are also present. R.N.A.

N66-26258*# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Electrical Engineering.

A SPACE COMMUNICATIONS STUDY Progress Report, Sep. 15–Mar. 15, 1966

Kenneth K. Clarke, Raymond L. Pickholtz, and Donald L. Schilling [1966] 32 p

(Grant NGR-33-006-020)

(NASA-CR-74967) CFSTI: HC $2.00/MF $0.50 CSCL 17B

Continuing development in theoretical analysis and instrumentation is briefly described. Phase locked loop threshold performance and intermodulation are discussed. FM discriminator response and error problems are considered. Digital techniques, optimum estimators, and FM generators are mentioned. Schematic diagrams of instrumentation and graphs of experimental and theoretical data are included. N.E.N.

N66-26261*# Ohio State Univ. Research Foundation, Columbus. Dept. of Electrical Engineering.

RECEIVER TECHNIQUES AND DETECTORS FOR USE AT MILLIMETER AND SUBMILLIMETER WAVELENGTHS Semiannual Report, 1 Oct. 1965–31 Mar. 1966

1 Apr. 1966 11 p *Its* Rept.-1093-30

(Grant NsG-74-60)

(NASA-CR-74971) CFSTI: HC $1.00/MF $0.50 CSCL 09F

Investigations on water vapor absorption in the submillimeter region are reported. The absorption positions are considered to agree with published theoretical values. However, a significant time delay was noticed, which had a degrading influence on measurements. Modifications in the analog–digital conversion and recording system are reported to decrease digital noise and increase reliability. The completed construction of an external-mirror CO_2 laser and the initiation of a laser made of glass parts bolted together are mentioned. N.E.N.

N66-26282*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TELEMETRY ON-LINE MONITORING, COMPRESSION, AND TRANSMISSION (TOMCAT) SYSTEM FOR THE MANNED SPACE FLIGHT NETWORK. VOLUME 5: TOMCAT-II—2KB DATA TRANSMISSION PROGRAM

R. des Jardins, and L. H. Wentz, Jr. Mar. 1965 246 p
(NASA-TM-X-55485; X-546-65-116) CFSTI: HC $6.00/MF $1.50 CSLC 09F

This report describes the TOMCAT-II Systems Programs TOMCAT-IIA, which was used for systems evaluation and testing and for the GT-2 and GT-3 missions, and TOMCAT-IIB, which will be used for future Gemini missions. It contains detail flows and descriptive write-ups of all aspects of both programs. Appendices are included which contain a complete description of the input and output data configurations, and side-by-side assembler listings of the actual coding. The TOMCAT-IIB program remains in a fluid state, so as to be able to incorporate future requirements as they are requested. The present report documents the program as it existed on April 1, 1965. Several changes are already planned to implement additional requirements for GT-4, but these changes are of an incidental nature and the philosophy presented herein will continue to be observed in later editions. Author

N66-26288*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

SPACE PROGRAMS SUMMARY NO. 37-38, VOLUME III FOR THE PERIOD JANUARY 1 TO FEBRUARY 28, 1966. THE DEEP SPACE NETWORK

31 Mar. 1966 116 p refs
(Contract NAS7-100)
(NASA-CR-75155; JPL-SPS-37-38, Vol. III) CFSTI: HC $4.00/MF $0.75 CSCL 17B

The Deep Space Network (DSN), which is responsible for two way communications with unmanned spacecraft traveling from approximately 10,000 miles from earth to interplanetary distances, is described. Present facilities, it is pointed out, permit simultaneous control of a newly launched spacecraft and a second one already in flight. In preparation for the increased number of U.S. activities in space, a capability is being developed for simultaneous control of either two newly launched spacecraft plus two in flight, or four spacecraft in flight. Advanced communications techniques are being implemented to provide the possibility of obtaining data from, and tracking spacecraft to, planets as far out in space as Jupiter. The discussion is broken down into the following areas: (1) DSN systems design; (2) DSN inherent accuracy project; (3) communications research and development; (4) communications development engineering; (5) tracking stations engineering and operations; and (6) flight project activities. D.T.

N66-26296# Applied Data Research, Inc., Princeton, N. J.

COMMUNICATION WITH AUTOMATA, VOLUME I, SUPPLEMENT I Final Report

Carl Adam Petri Griffiss AFB, N. Y., RADC, Jan. 1966 98 p refs Prepared in cooperation with Computer Assoc. Inc., Wakefield, Mass. Transl. into ENGLISH of Kommunikation mit Authomaten (Bonn), 1962
(Contract AF 30(602)-3324)
(RADC-TR-65-377; AD-630125)

The theory of automata is shown not capable of representing the actual physical flow of information in the solution of a recursive problem. The argument proceeds as follows: (1) The following postulates are assumed: (a) there exists an upper bound on the speed of signals; (b) there exists an upper bound on the density with which information can be stored. (2) Automata of fixed, finite size can recognize, at best, only iteratively defined classes of input sequences. (3) Recursively defined classes of input sequences that cannot be defined iteratively can be recognized only by automata of unbounded size. (4) In order for an automaton to solve a (soluble) recursive problem, the possibility must be granted that it can be extended unboundedly in whatever way might be required. (5) Automata (as actual hardware) formulated in accordance with automata theory will, after a finite number of extensions, conflict with at least one of the postulates. Suitable conceptual structures for an exact theory of communication are then discussed, and a theory of communication proposed. TAB

N66-26298# Air Force Cambridge Research Labs., Bedford, Mass.

NUMERICAL SOLUTION OF FULL-WAVE EQUATION WITH MODE-COUPLING

Yuji Inoue and Samuel Horowitz Feb. 1966 40 p refs /its Phys. Sci. Res. Papers No. 196
(AFCRL-66-114; AD-630612) CFSTI: HC $3.60/MF $0.50

A new method for the numerical solution of the wave equation governing the propagation of electromagnetic waves in a horizontally stratified, inhomogeneous, anisotropic layer is described. The wave equation is a homogeneous set of four linear differential equations of the first order. In the computer calculation, all singularities of the wave equation are removed in practical cases and a proper step-size based on the gradients of the medium properties is programmed automatically. The multiplicative nature of the solutions facilitates the procedure. Modification of solutions from one height to another is expressed in explicit form on the assumption that the propagation tensor varies linearly with height in each step of integration. In the mathematical development, matrix operations are extensively used in order to achieve a general representation. Four independent solutions of the wave equation are derived. During an ordinary integration for an inhomogeneous medium, a degradation occurs inevitably in the degree of linear independence among special solutions. This cause is analyzed. To obtain a complete set of special solutions with good linear independence, a particular device is developed for general applications. This method has been programmed for computer calculation by an IBM 7090. The resultant wave fields and wave polarizations for the independent modes are shown for a model ionosphere. The resultant wave is described as a 'scrambling' of four characteristic waves. The 'scrambling' state is visualized at each height. Author (TAB)

N66-26333# Washington Univ., Seattle. Dept. of Electrical Engineering.

THE FIELD ALONG THE SURFACE OF A GROUNDED DIELECTRIC SLAB COVERED BY A PERIODICALLY SLOTTED CONDUCTING PLANE Technical Report No. 102

Rubens A. Sigelmann Jan. 1966 40 p refs
(Contract AF 19(628)-2763)
(AFCRL-66-104; AD-630003) CFSTI: HC $3.60/MF $0.50

This paper deals with the field on the surface of a dielectric slab covered by a periodically slotted conducting plane. The field is excited by a line of magnetic current. A sampling technique is used to formulate this problem. The field obtained by this method consists of a radiation field and contributions of surface and leaky waves. The beta-k diagram obtained by a sampling technique is compared with diagrams

obtained by a variational method and experimentally. A graphical solution for the dispersion curve is presented. Surface waves that result from the solution in the 'improper' Riemann surfaces are discussed. Author (TAB)

N66-26416# Norwegian Defence Research Establishment, Kjeller.
LONG RANGE PROPAGATION STUDIES Annual Summary Report No. 1, 15 Sep. 1964–15 Jul. 1965
K. Folkestad 10 Sep. 1965 52 p refs
(Contract AF 61(052)-835)
(E-64; AFCRL-66-11; AD-631042) CFSTI: HC $5.60/MF $0.50

This report describes activity associated with step-frequency oblique soundings in Norway. Pertinent operational parameters are given. Results from ray-path calculations and their relation to measured data are presented. The outcome from analysing different types of backscatter-echoes is offered. One of the chapters is devoted to a treatment of various characteristics of auroral radio-reflections. Another chapter deals with the communicational aspect of the experiment. Summary and conclusions are inserted in the final chapter. Author (TAB)

N66-26421# Innsbruck Univ. (Austria).
ON THE PROPAGATION OF VLF WAVES IN SOLIDS Final Scientific Report
W. Bitterlich Dec. 1965 109 p refs
(Contract AF 61(052)-490)
(AFCRL-66-211; AD-631046) CFSTI: HC $4.00/MF $0.75

In the present report, the propagation of VLF waves in solid media is described by theory and experiment for the near field and for the subsequent transition zone to the far field. The decisive parameters: conductivity, and dielectric constant are determined by independent methods of measurement. The required instruments, largely designed by our team, are described. The theory of a magnetic transmitting dipole is checked and modified by a number of measurements in regions of different geological conditions. Author (TAB)

N66-26424# Simmonds Precision Products, Inc., Tarrytown, N. Y.
AN/PRC-65 RADIO SET
Edward M. Ulicki Griffiss AFB, N. Y., RADC, Mar. 1966 99 p
(Contract AF 30(602)-3445)
(PD-5536; RADC-TR-65-211; AD-631084) CFSTI: HC $9.60/MF $0.75

The task was to design and develop an ultra-miniature, high-reliability radio set, having over 1000 channels operating in the VHF frequency range of 100 to 156 mc. This radio set is to operate from a single crystal source, transmit in the given frequency range in 50 kc steps, and have the capability of changing frequencies by means of a single digital switch. The radio set uses many new innovations and techniques, some of which are: a broadband transceiver which is untuned except for a bandpass filter; a digital frequency synthesizer to obtain the large number of channels from a single frequency source; and integrated and thin-film circuits for obtaining high packaging volume and high reliability. Extensive development work was expended on designing the broadband RF power amplifier and its associated modulator. These circuits have proven to be very successful and can be adapted for extension in the UHF frequency range of 225 to 400 mc. Author (TAB)

N66-26435# Mitre Corp., Bedford, Mass.
POLARIZATION EXTENSIONS OF THE MONOSTATIC–BISTATIC EQUIVALENCE THEOREM
S. H. Bickel Jan. 1966 20 p refs
(Contract AF 19(628)-5165; ARPA Order 596; Proj. Defender)
(TM-4242; ESD-TR-65-150; AD-630864) CFSTI: HC $1.60/MF $0.50

For convex non-depolarizing bodies, the monostatic–bistatic approximation is exact to first order terms in the bistatic angle. The second order error effect causes widening of the lobe structure with increasing bistatic angle. For depolarizing bodies, the error is again second order in the bistatic angle provided that the depolarizing edges have parallel orientation. Consequently, the theorem can be extended to convex bodies of revolution. Author (TAB)

N66-26437# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
APPLICATION OF PRE-DETECTION AND RECORDING TECHNIQUES TO DATA COLLECTION SYSTEMS
Ray D. Lucas 30 Nov. 1965 40 p refs
(Contract DA-28-043-AMC-00379(E))
(EDL-M859; AD-629889) CFSTI: HC $2.00/MF $0.50

The report evaluates pre-detection recording techniques for uncooperative signal acquisition with particular emphasis on the problems associated with wide band, wide dynamic range AM signals. Since the pre-detection recording process is placed in series, between the IF amplifier and the data processing circuits, new sources of noise and distortion are introduced. One of the basic problems is to identify the sources of signal degradation in the pre-detection process. The influence of receiver characteristics on the pre-detection recording process is discussed in Section 3. In Section 4, several techniques for down-conversion of IF signals to a center frequency compatible with a wideband tape recorder are discussed. Section 5 discusses tape recording techniques and Section 6 reviews the relative merits of several up-conversion schemes. The specific problems associated with pre-detection recording of AM signals are discussed in Section 7. Appendix A develops a scheme for a broadband 90-degree phase shifter which is of considerable value to the up-conversion problem, and gives the test results of a breadboard of the phase shifter. Appendix B gives the test results on a commercially available down-converter. Appendix C, written by L. N. Ferguson, discusses the 'care and feeding' of wide band tape recorders. Author (TAB)

N66-26442# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PHASED ARRAY RADAR STUDIES Technical Report No. 381, 1 Jan. 1963–1 Jul. 1964
John L. Allen et al 31 Mar. 1965 346 p refs
(Contract AF 19(628)-500)
(ESD-TDR-65-66; AD-629363) CFSTI: HC $34.20/MF $1.75

The report is the fourth in the series of reports describing the work of a general research nature carried out by the Lincoln Laboratory Array Radars Groups. The effort reported is directed toward an investigation of components, techniques, and fundamental theoretical limitations of arrays, primarily for high-power radar applications. The emphasis is on those applications which place the most stringent demands on the radar for resolution of very small targets from backgrounds of extensive and relatively large clutter (arrays with capability for high power, broad bandwidth, and narrow beamwidth). Part I deals with the concluding activities on the 900-Mcps test array, emphasizing the configuration of the transmitting array and our

experiences with it. Part II is devoted to work on an S-band subarray transmitter configured around the use of high-power helical phase shifters. Part III deals with theoretical and experimental studies in multiple-beam-forming systems and studies in mutual-coupling effects. Author (TAB)

N66-26561# Harvard Univ., Cambridge, Mass. Cruft Lab.
THEORY OF THE BALANCED HELICAL WIRE ANTENNA Scientific Report No. 12 (Series 3)
Chin-Lin Chen Jan. 1966 80 p refs
(Contract AF 19(628)-2406)
(AFCRL-66-120; AD-631040) CFSTI: HC $3.00/MF $0.75

A finite, balanced helical wire antenna excited by a delta-function generator is investigated. The geometry of a helical wire is examined and an exact integral equation for the current distribution along the antenna is formulated. For a thin helical wire, the exact integral equation can be approximated by a one-dimensional approximation, which can be solved by a Fourier-series method. In the solution, the logarithmic singularity at the driving point is taken into account and is subsequently substracted out. Thus, the input admittance is obtained. The theoretical results are compared with the experimental result. It is found that the current amplitude decays exponentially. This is contradictory to the usual assumption that the current along a helical antenna is a traveling wave with a constant amplitude. Author (TAB)

N66-26564# General Electric Co., Syracuse, N. Y. Heavy Military Electronics Div.
MIRAGE (MICROELECTRONIC RADAR INDICATOR FOR GROUND EQUIPMENT) Final Report, 6 Dec. 1964–30 Jun. 1965
William E. Wickes, E. T. Combes, D. W. Perkins, and J. W. Boortz Griffiss AFB, N. Y., RADC, Mar. 1966 65 p ref
(Contract AF 30(602)-3572)
(TIS-R65FMH22; RADC-TR-65-335, Vol. I; AD-631180) CFSTI: HC $3.00/MF $0.75

A final report is presented on microelectronic radar indicator for ground equipment known as MIRAGE MIRAGE is the first attempt to eliminate the electromechanical devices such as resolvers, synchros, gear trains and electric motors inherent to PPI displays by the use of digital silicon integrated circuit techniques. By the use of digital techniques a 10-inch PPI display was developed that weights 63 pounds, has a volume of 2.2 cubic feet and consumes 85% watts of power. All the circuits in this PPI are transistorized (except the CRT itself) and actually 98% of the circuits are of the silicon integrated type. The circuits that are still conventional transistorized were designed to be easily integratable at a later date. Author

N66-26580# Lincoln Lab., Mass Inst. of Tech., Lexington.
A METHOD FOR ESTIMATING THE PARAMETERS OF A STABLE DIFFERENCE EQUATION DRIVEN BY SINUSOIDS AND OBSERVED IN THE PRESENCE OF NONWHITE NOISE
Leland A. Gardner, Jr. 11 Feb. 1966 38 p *Its* Tech. Note 1966-9
(Contract AF 19(628)-5167)
(ESD-TDR-66-41; AD-629934) CFSTI: HC $3.60/MF $0.50

A computationally feasible and consistent method is considered for estimating the parameters of a stable difference equation. The steady-state solution is observed in the presence of nonwhite noise, and the system is driven by a selected superposition of sinusoids. The deterministic input sequence is used up to unknown gain; and corresponding to the superposition of sinusoidal inputs, an estimate is made of the p+1 parameters having the following properties: (1) on-line computation of estimates can be done recursively, (2) the estimate is strongly consistent under very weak conditions on the noise process as the observation time increases to infinity, and (3) standardized estimates tend to joint normality with a covariance matrix which is relatively easy to calculate for white noise. Simple instantaneous nonlinear operations are performed on least squares solutions; and the result is mapped by fixed matrix into an estimate of the ratio of coefficients to gain. M.W.R.

N66-26589# Scientific-Atlanta, Inc., Atlanta, Ga.
INVESTIGATION OF PRECISION ANTENNA PATTERN RECORDING AND DISPLAY TECHNIQUES PHASE II Final Report, Vol. I
J. Searcy Hollis, Samuel F. Hutchins, T. J. Lyon, Rezin E. Pidgeon, Jr., and C. S. Young Griffiss AFB, N. Y., RADC, Feb. 1966 157 p refs
(Contract AF 30(602)-3425)
(RADC-TR-65-534, Vol. I; AD-630124) CFSTI: HC $5.00/MF $1.00

The purpose of the research is the development of equipment to enhance the antenna measurement capability of ground-based antenna test ranges. Theoretical studies reported herein include an investigation of environmental effects and an analysis of parallax errors as related to high-accuracy antenna measurements; and investigation of antenna-positioning techniques and angle-measuring equipment; and a determination of optimum techniques for a high-speed precision recording system. TAB

N66-26599# Sperry Gyroscope Co., Great Neck, N. Y. Radiation Div.
ECM AEROSPACE ANTENNA STUDIES, VOLUME 2 First Quarterly Technical Report
Gerald Meltz, Richard Kristal, and Peter K. Shizume Dec. 1965 31 p refs
(Contract AF 19(628)-5531; ARPA Order 693)
(RD-5291-0680, Vol. 2; AFCRL-66-865(2); AD-630049) CFSTI: HC $2.00/MF $0.50

The report covers the first quarter of work on Volume II. Volume II includes the work done under Task III, Re-Entry Plasma Simulations, and Task IV, Analytical Plasma Calculations. The purpose of Task III is to develop a laboratory simulation of the re-entry plasma about scale models of reentry vehicles carrying antennas and to make measurements of antenna pattern distortion and attenuation for various conditions of the plasma. This report covers the construction of parts of the simulator during the first quarter. The purpose of Task IV is to develop analytic techniques based on approximate boundary conditions for describing pattern distortion for antennas mounted on conical re-entry vehicles, and to develop methods for calculating the terminal impedance of plasma antennas. Calculations of the terminal admittance of a plasma coated slotted cylinder are given in this report for the case of a lossless plasma layer as a function to layer thickness and dielectric constant. The admittance is also calculated for a long plasma layer as a function of ω_p/ω. $\nu_7/\omega=0.1$ and for various frequencies and layer thickness. The theoretical results are compared against experimentally determined values and are shown to compare favorably. Author (TAB)

N66-26613# Emmanuel Coll., Boston, Mass. Research Language Center.
DIRECT SOUNDING STUDIES OF THE IONOSPHERE

Chou Wei Bedford, Mass., AFCRL, Sep. 1965 46 p refs Transl. into ENGLISH from Ti Ch'iu Wu-Li Hsueh-Pao (China), v. 12, no. 1, 1963 p 100–117
(Contract AF 19(628)-5073)
(EMM-65-28; TT-66-61010; AD-631061) CFSTI: HC $2.00/MF $0.50

This paper describes various methods for studying the ionosphere and radio wave propagation using rockets and artificial satellites. It shows the relationships between these methods and illustrates certain essential results which have been obtained so far. It also discusses briefly the future trend in further studies on this subject. Author (TAB)

N66-26614# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
RESEARCH ON PROPAGATION OF HIGH POWER WAVES IN IONIZED MEDIA Final Scientific Report
O. E. H. Rydbeck Jun. 1965 10 p refs
(Contract AF 61(052)-451)
(US-44; AFCRL-66-128; AD-631047) CFSTI: HC $1.10/MF $0.50

Emphasis is placed on linear wave propagation in a double hump barrier and properties of coupled magneto-ionic equations, in a research program on the propagation of high power waves in an ionized media. A complete expression for the hump barrier was obtained in terms of internal reflection and transmission coefficients (of the hump and valley regions). Included are accomplishments in such other areas as self-oscillations of the pumped, ionized medium; an extension of Oseen's extinction theorem; nonlinear magneto-ionic wave propagation; and wave propagation in ionized media when the thermal velocity of the electrons is taken into account.
C.T.C.

N66-26623# Montana State Coll., Bozeman. Electronics Research Lab.
A SURVEY OF SOLID STATE D.C. POWER SUPPLY CONFIGURATIONS FOR HIGH POWER Final Report
George Berges Sep. 1965 12 p refs
(Contract N123(953)53308A)
(AD-630567) CFSTI: HC $1.00/MF $0.50

In order to produce the most efficient and reliable communication system for shipboard use by the U.S. Navy, it is proposed that P.A. couplers of an octave range be used instead of conventional 2–32 mc transmitters. This configuration will require a considerably greater number of P.A. couplers; however, the amplifier per unit cost and complexity is greatly reduced. However, at 10 kw power level, the power supply of each P.A. becomes significant in size and weight. If the proposed system is to be feasible, considerable size and weight must be saved over conventional 60-cycle power supply designs. The purpose of this cursory study is to do preliminary investigation into power supply size and weight savings with an eye on cost. Two different supplies are being considered: a unit, 16 KVA supply, to power an individual P.A. coupler; and a composite 160 KVA supply, to power 10 units from a central point. TAB

N66-26625# Naval Research Lab., Washington, D. C.
POLAR VIDEO GATING OF RADAR AND IFF DISPLAYS USING CARTESIAN CONTROL Interim Report
F. R. Fluhr 21 Feb. 1966 14 p refs
(NRL-6372; AD-630202) CFSTI: HC $1.00/MF $0.50

Many data-processing operations require the rapid and accurate extraction of position data from cathode-ray-tube information sources such as radar, IFF, and sonar PPI repeaters. An IFF Active Readout System under development required gating out IFF video responses at positions controlled by a hook position marker. In this implementation, the hook marker is presented on the PPI in x-y coordinates during the radar repeater recovery or retrace period. A means was devised of developing a video gate control which gates the video with a constant angular width and constant range depth using the x and y dc hook position voltages and the PPI repeater resolved x and y sweep voltages. The computation uses an analog approximation technique which is relatively simple. The approximation deviates from the ideal less than 0.5% for a 10 degree angular width gate. This deviation can be eliminated by the addition of a simple compensation scheme. The video gating method can be implemented digitally for those PPI displays using digital sweeps. Author (TAB)

N66-26668# New York Univ., N. Y. Lab. for Electroscience Research.
THE TRANSMISSION CYCLE PARAMETER IN FEEDBACK COMMUNICATION SYSTEMS Third Scientific Report
John J. Metzner and Kenneth C. Morgan Nov. 1965 36 p refs Its Tech. Rept. 400-126
(Contract AF 19(628)-4321)
(AFCRL-66-22; AD-630560)

The problem of proper relative timing of the word transmissions from the two ends of a communication feedback system is examined for a number of system configurations. The transmission cycle parameter J is derived as a function of the several system delays and the feedback procedures used. It is shown that the smallest possible value of J can be computed in each situation. Furthermore, the lower bound on J can be attained in some cases by making the times of initiation of code words at the two stations coincide and in all other cases by initiating each word at one station just halfway between the initiation of successive words at the other station. In most circumstances some leeway in the required relative timing exists. Author (TAB)

N66-26673# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
MICROWAVE OPTICAL RECEIVER TECHNIQUES Interim Engineering Report, 1 Dec. 1965–28 Feb. 1966
J. Richard Kerr [1966] 42 p refs
(Contract AF 33(615)-3108)
(IER-3; AD-629242) CFSTI: HC $2.00/MF $0.50

This report represents the results of the third quarter of effort on a one-year applied research program on the use of various techniques for microwave optical communications through the atmosphere. Various techniques for microwave optical heterodyning are evaluated, and it is shown that the transition from a laboratory to a field environment is not a straightforward one. A direct detection experiment through the atmosphere with an avalanche photo-diode containing a very small active area has shown that atmospheric turbulence need not limit the performance of such devices beyond those effects which apply to all incoherent optical receivers. A novel modulation–demodulation scheme is proposed in which an arbitrarily large Pockels cell index may be used with zero distortion in the received signal. Author (TAB)

N66-26679# Emmanuel Coll., Boston, Mass. Oriental Science Library.
SUPPRESSION OF SIDE-LOBES OF LINEAR ARRAYS

L. Jen and M. Y. Loo Bedford, Mass., AFCRL, Nov. 1965 16 p refs Transl. into ENGLISH from Wu Li Hsueh Pao (Peking), v. 17, no. 12, 1961 p 592–599
(Contract AF 19(628)-5073)
(EMM-65-8; AD-631083) CFSTI: HC $1.00/MF $0.50

For the purpose of suppressing the side-lobes near the main beam of radiation, this paper gives a distribution function for the roots of the complex polynomial corresponding to the nulls of the radiation pattern of a non-uniform array on the unit circle in a complex plane. Computed results show that by means of this distribution function, a better control of the radiation pattern of a non-uniform linear array can be acquired, especially for the purpose of suppressing the first few side-lobes near the main beam, which is important in certain applications, at the expense of increasing the relatively far off side-lobes. However, the most far off side-lobe can be suitably reduced by the appropriate shifting of the last null. Author

N66-26700*# Computer Control Co., Inc., Framingham, Mass.
PCM-FM; PAM-FM/FM SIMULATOR Final Report
16 Apr. 1966 11 p *Its* Doc.-130071556
(Contract NAS8-11589)
(NASA-CR-75071) CFSTI: HC $1.00/MF $0.50 CSCL 09F

A test pattern generator to enable automatic calibration of vehicle telemetry systems and associated ground equipment was developed. Its components are briefly described, and photographs and a block diagram of the instrument are shown. H.S.W.

N66-26708# Ohio State Univ. Research Foundation, Columbus. Antenna Lab.
HIGH GAIN ANTENNA TECHNIQUES. SYSTEM GAIN-TO-NOISE TEMPERATURE RATIO MEASUREMENTS ON AN ADAPTIVELY PHASED ARRAY Technical Interim Report
Delmer D. Hayes Griffiss AFB, N. Y., RADC, Mar. 1966 78 p refs *Its* Rept.-1963-1
(Contract AF 30(602)-3601)
(RADC-TR-66-125, Vol. I; AD-630872) CFSTI: HC $7.60/MF $0.75

Factors affecting the ultimate sensitivity of a typical microwave receiving system are discussed. It is shown that the receiver noise-temperature and the antenna gain-to-noise-temperature ratio are the dominant parameters in determining system capabilities. Data is presented, along with the technique used to obtain the data, for the receiver noise temperature, the antenna gain, and the antenna noise temperature for each element of the array. An expression is developed for the gain-to-noise-temperature ratio of the array and is shown to be equivalent to an enhancement factor operating on the individual element gain-to-noise-temperature ratio. The effects of system parameter variations are studied and typical values of enhancement factor are calculated. It is concluded that for minor variations in parameters the enhancement factor is affected very little. Author (TAB)

N66-26763*# General Electric Co., Daytona Beach, Fla. Apollo Support Dept.
SINGLE PARAMETER TESTING, PHASE D Final Report
E. L. Berger, C. A. Grunden, and J. T. Sterling Apr. 1966 53 p refs *Its* Rept.-66-SIMAR-10417
(Contract NAS8-11715)
(NASA-CR-75258) CFSTI: HC $3.00/MF $0.50 CSCL 09F

The general usefulness of single parameter testing techniques as applied to the specific components being tested and analyzed was assessed. It was found that the testing procedures were not applicable for the rf equipment, the telemetry group components, or the networks components. The procedures were considered valid for the measuring instruments, where the major test is to check the calibration of the component. The details for the testing of specific components in this group are presented. Brief investigations of electromechanical, pneumatic and hydraulic systems and components showed that the methods developed are applicable to these systems. N.E.N.

N66-26781# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON ELECTROTECHNOLOGY [LITERATUUROVERZICHT ELECTROTECHNIEK]
7 Apr. 1966 33 p refs In DUTCH, ENGLISH, FRENCH, and GERMAN *Its* Vol. 15, No. E-484
CFSTI: HC $2.00/MF $0.50

Abstracts and bibliographic notes are presented on the topics of telecommunications, electronics and microwave techniques, radar, electromagnetic radiation, geometry, information processing, software computers and applications, measurement techniques, reduction, oscillators and magnifiers, components and materials, electronic instruments for ships, and halogen lamps. Transl. by J.O.

N66-26826# IIT Research Inst., Chicago, Ill. Coordinated Science Lab.
STOCHASTIC FLOW OF MESSAGES AND ITS EFFICIENT TRANSMISSION THROUGH COMMUNICATION NETS
Kenji Onago Nov. 1965 18 p refs
(Contract DA-28-043-AMC-00073(E); Grant AF-AFOSR-49)
(R-269; AD-624255) CFSTI: HC $1.00/MF $0.50

Efficient transmission of stochastic flow of messages through store-and-forward type communication nets is discussed in this paper. In order to express quality or performance of flow psi quantitatively, we define the penalty index P (psi) as the sum of total time delay D (psi), total transmission cost K (psi), and total transmission redundancy R (psi) with certain proportions of penalty. A necessary and sufficient condition of minimum penalty flow for the fixed flow value is obtained in Theorem 4 and is demonstrated by a simple example. Author (TAB)

N66-26834# Ohio State Univ. Research Foundation, Columbus. Antenna Lab.
HIGH GAIN ANTENNA TECHNIQUES. AN APPROACH TO THE DESIGN OF THE CASSEGRAIN ANTENNA Interim Technical Report
Tsutomu Suzuki Griffiss AFB, N. Y., RADC, Mar. 1966 45 p refs *Its* Rept.-1963-5
(Contract AF 30(602)-3601)
(RADC-TR-66-125, Vol. II; AD-630873) CFSTI: HC $4.60/MF $0.50

An evaluation of the design philosophies and procedures of the Cassegrain antenna is presented. An approach to the practical design of and quantitative calculations for the parameters of a Cassegrain antenna to be installed at The Ohio State University Antenna Laboratory are described. Author (TAB)

N66-26866*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1964 TELECOMMUNICATION SYSTEM
John A. Hunter 1 Dec. 1965 21 p refs
(Contract NAS7-100)
(NASA-CR-75274; JPL-TR-32-836) CFSTI: HC $1.00/MF $0.50 CSCL 17B

This report describes the radio, telemetry, and command subsystems of the Mariner Mars 1964 telecommunication system and presents a summary of system performance during the mission. For this mission the Mariner IV required a telecommunications system providing telemetry, command, and Doppler tracking capabilities over ranges approaching 260×10^6 km. By utilizing unique characteristics of the Mars 1964 minimum energy trajectories, it was possible to meet this requirement without a pointable antenna and the associated complex spacecraft equipment. Spacecraft equipment design was based on techniques used for the Mariner II spacecraft, with modifications to increase reliability and accommodate the increased maximum communication range. Author

N66-26869*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF THE INTERACTION OF THE SURVEYOR RADAR ALTIMETER DOPPLER VELOCITY SENSOR SYSTEM AND VERNIER THRUST CHAMBER PLUMES
A. J. Kelly 15 Apr. 1966 22 p refs
(Contract NAS7-100)
(NASA-CR-75271; JPL-TM-32-927) CFSTI: HC $1.00/MF $0.50 CSCL 17I

The analyses of the interaction of the Surveyor radar altimeter Doppler velocity sensor (RADVS) system and vernier thrust chamber plumes were specifically conducted to provide conservative estimates of the interactions effects. In all instances, operating conditions were assumed which, while consistent with Surveyor system specifications, would exaggerate the RADVS–plume interaction. All assumptions made during the course of analysis permitted an upper bound to be placed on the interaction of the vernier plumes and the RADVS system. As a consequence, no attempt was made to provide a detailed assessment of the most probable level of RADVS–plume interaction to be expected. The maximum calculated two-way attenuation and reflection level are both well below the levels at which the performance of the RADVS system would be significantly influenced. However, the nonstatic two-way phase-shift was found to be in excess of the level above which the operation of the RADVS system would be affected. Author

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N66-25446# Japan Broadcasting Corp., Tokyo. Technical Research Labs.
AUTOMATIC VIDEO TAPE EDITING SYSTEM USING PROCESS COMPUTER
Y. Fujimura, S. Iwamura, A. Matsumae, and T. Otani Jan. 1966 30 p
(S-5) CFSTI: HC $2.00/MF $0.50

In order to make the video tape editing task as easy as that of films and thereby justify television program production with video tape recorders, a new automatic video tape editing system was developed to replace the conventional splicing system. The system is based on the electronic dub in principle and provides coded time signal for minutes, seconds, and frames over the entire length of the tape. With this address as reference, all tape joining operation is automated by means of two sets of conventional 4-head VTR controlled by a monofunction process computer with magnetic drum memory. The time consumption for automatic dubbing is about twice the program time. As input/output devices of the editing information, a helical scan VTR capable of producing still or slow motion pictures is used. The picture of this VTR and some other displays facilitate judgment on the editing points, and the editor's image can be transferred to the drum memory automatically by easy push button operation. R.N.A.

N66-25594# Weapons Research Establishment, Salisbury (Australia).
INTRODUCTION TO BUNKER-RAMO CONTROLLER SET 144, CONTROLLER LOGIC AND MNEMONICS
I. Holthouse Jan. 1966 26 p ref *Its* Ikara Paper No. 94
(WRE-WPD-31) CFSTI: HC $2.00/MF $0.50

This note is intended to give a greater understanding to BR-144 Controller elements and their functions. In fact the element tables give all information needed for maintenance, fault finding, and a quick reference for use with the Model 144 Controller Set Technical Manual. Author

N66-25870# System Development Corp., Santa Monica, Calif.
HUMAN ENGINEERING THE GPDS/LUCID SYSTEM: CONSIDERATIONS AND PLANS
Charles W. Simon 30 Nov. 1965 30 p refs
(Contract AF 19(628)-5166)
(SDC-TM-2776; AD-628206) CFSTI: HC $2.00/MF $0.50

Human engineering considerations and plans for the study and evaluation of the GPDS/LUCID system are discussed. Specific project goals are: (1) to determine how well the current systems match users' needs and (2) to make recommendations for improving the system where these needs are not met. An ultimate project goal will be to determine human engineering design principles useful for the development of user-oriented, on-line information processing systems in general. Project investigation will examine the GPDS/LUCID systems from the point of view of a user who is essentially unsophisticated in computer programming. Author (TAB)

N66-25881# RAND Corp., Santa Monica, Calif.
IDENTIFICATION FROM APERIODIC DISCRETE-TIME DATA WITH APPLICATIONS TO THE ESTIMATION OF EXPONENTIAL PARAMETERS
Allen Klinger Mar. 1966 21 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4919-PR; AD-630300) CFSTI: HC $2.60/MF $0.50

A method for the identification of a single-input single-output time-invariant linear system from an arbitrary set of discrete-time observations is described. Interpolatory procedures are used to express the unknown parameters in terms of the data. Applications of the procedure to an overdamped second-order system are included and the identification method is shown related to the resolution of a set of

discrete-data into a weighted sum of exponentials, and hence to Prony's method for equally-spaced discrete-data. The results compare well with those of other methods when linear interpolation is used to obtain the equally-spaced or other special data required by alternate procedures. Computer results indicate that the procedure can be used to identify systems when only limited quantities of aperiodic data are available, and that it could be used in a comprehensive digital computer program for identification for an adaptive control system. Author (TAB)

N66-25885# Air Force Systems Command, Kirtland AFB, N. Mex. AF Weapons Lab.

PPA, A COMPUTER PROGRAM FOR PHOTO-PEAK ANALYSIS Technical Report, Jul.–Dec. 1965

Harry M. Murphy, Jr. Mar. 1966 57 p refs

(AFWL-TR-65-111; AD-630389) CFSTI: HC $3.00/MF $0.75

PPA (Photo-Peak Analysis) is a simple FORTRAN computer code, that fits photo-peaks in pulse-height gamma ray scintillation spectra, and gives results in terms that are immediately useful to the gamma-ray spectroscopist. PPA fits experimental data with a Gaussian (Normal) distribution function, containing a linear bias term through the use of an iterative, least-squares technique. As many as five photo-peaks can be fitted by PPA in any given experimental spectrum with the following results: (1) the exact channel location of the photo-peak; (2) the width of the photo-peak (FWHM); (3) the peak count rate; (4) the integrated photo-peak count rate and (5) the integrated photo-peak count rate corrected for radioactive decay to 'zero-time.' The mathematics involved in the analysis, the input data required, and the results of some experimental measurements, as well as some typical applications of the code are discussed. In addition, a complete FORTRAN listing with flow diagrams is given. Author (TAB)

N66-25904# RAND Corp., Santa Monica, Calif.

COMPUTATIONAL LINGUISTICS: BIBLIOGRAPHY, 1964

David G. Hays and Roxana Ma Mar. 1965 66 p refs

(Contract AF 49(638)-700; Proj. RAND)

(RM-4523-PR; AD-613311) CFSTI: HC $3.00/MF $0.75

A bibliography is presented which cites 809 U.S. and foreign articles, reports, and books relevant to the fields of computational linguistics and documentation, with selective coverage in the fields of classification theory, computation and programming, computers and hardware, non-numerical applications of computers, and psycholinguistics. In the area of linguistics, a broad view is taken of structural theory and semantics without being exhaustive. R.N.A.

N66-25929# Pacific Missile Range, Point Mugu, Calif.

ERROR-BOUND METHODS FOR MULTIPLE-STATION DATA REDUCTION

R. W. Claassen and C. J. Thorne 4 Mar. 1966 43 p refs

(PMR-TM-66-2; AD-629976) CFSTI: HC $4.60/MF $0.50

A computer program and the related mathematical analysis is given for the calculation of accuracy bounds for the position of an object in space. The method involves the reduction of data from n-stations using the present PMR least-squares n-station method. Author (TAB)

N66-25947# Lowell Technological Inst. Research Foundation, Mass.

RESEARCH DIRECTED TOWARD PATTERN RECOGNITION CAPABILITIES OF WAVE PROCESSES IN ACTIVE ISOTROPIC PROPAGATING MEDIA Final Report, 1 Feb. 1963–31 Jan. 1966

David G. Mello and George J. English Jan. 1966 156 p refs

(Contract AF 19(628)-2485)

(AFCRL-66-90; AD-630340) CFSTI: HC $5.00/MF $1.00

The purpose of the research reported here was to show experimentally and prove mathematically the nature of H. Blum's hypothesis of signal propagation and abstract transformation. Two machines were developed to transform signals from parallel-spatial input to sequential-temporal output. The first of these was an optical device; the second, an electronic analog of the first, incorporating an internal signal processor. Concurrent mathematical studies provided formal proof of the consistency of such a process. Author (TAB)

N66-26098# Joint Publications Research Service, Washington, D. C.

EVALUATION OF THE EFFECTIVENESS OF DIGITAL COMPUTERS

A. S. Vayradyan, L. N. Sumarkov, and Ya. A. Khetagurov *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 65–73 refs (See N66-26086 14-14) CFSTI: $6.00

A criterion, specific unreliability, is proposed for the evaluation of digital computers. This criterion takes into consideration the characteristics of the computer and the algorithm of the problem being solved. A mathematical expression for determining the specific unreliability of a system is given and it is used to evaluate two sample cases. H.S.W.

N66-26099# Joint Publications Research Service, Washington, D. C.

CONTACTLESS PARALLEL COMPUTATION "SHAFT-ENCODER" CONVERTER

V. I. Pautov, B. N. Savel'yev, and V. P. Skuridin *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 74–79 (See N66-26086 14-14) CFSTI: $6.00

The article considers one of the possible variations in the design of a "shaft-encoder" converter with an intermediate phase-shift conversion operating on the principle of parallel computation. The theoretical basis of the proposed method is given along with its experimental substantiation. Author

N66-26100# Joint Publications Research Service, Washington, D. C.

ARITHMETICAL POSSIBILITIES OF "2 OUT OF 5" CODE

F. Ya. Galkin *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 80–84 refs (See N66-26086 14-14) CFSTI: $6.00

Coding systems for digital computers in which sequence numbers are obtained by shifting are considered, and a method is proposed for obtaining two out of five bits circular systems which would allow arithmetical computations using this code. It is assumed that a coding mask, acted upon by four brushes, is attached to the decimal counting wheel, and it is shown that by properly positioning these brushes, it is possible to select two out of five code symbols without repeating a symbol. Additionally it is reported that circular systems may be obtained by using electronic devices and a discussion of the advantages of these systems is provided. H.S.W.

N66-26171# Library of Congress, Washington, D. C. Aerospace Technology Div.

COMPUTER TECHNOLOGY Surveys of Soviet Scientific and Technical Literature

Joseph J. Podoski and Vladimir Podpaly 25 Jan. 1966 36 p refs Annotated Bibliog.

(ATD-66-12)

This bibliography was compiled from Soviet open sources published 1961–1964. It is the fourth in a series of reports reviewing Soviet developments in computer technology. Information not directly related to the assigned subject has been included because of its broad implications for study in this field. The 254 entries are arranged alphabetically by author within each of the years covered (46 for 1961, 59 for 1962, 59 for 1963, and 90 for 1964). A list of the journals scanned in preparation of the bibliography is included. Other information covered: transistorized amplifier, binary codes, magnetic tape, problem programming, algorithm coding and programming, wide-band thyrite multiplying and dividing device, ferromagnetic films, pneumatic circuits, parametric resonators with ferrite cores, magnetic drum storage unit, transistorized precision integrator, analog-digital converter, potentiometer, photoelectronic decoder, pulse divider, magnetic circuit, amplifiers, differentiating and integrating circuits, ful-key relay computer, digital-to-analog converter, tunnel-diode detector, nonlinear programming, trigger circuit, flip-flops, functional converter, ferrite storage unit, memory unit, delay line, encoder, and printing device.

Author

N66-26306# Mitre Corp., Bedford, Mass.

THE MUSE SYSTEM: DESCRIPTION AND MANUAL FOR OPERATION

A. Wayne Slawson Bedford, Mass., AFSC, Electron. Systems Div., Dec. 1965 49 p refs

(Contract AF 19(628)-2390)

(TM-03913; ESD-TR-65-94; AD-625734) CFSTI: HC $2.00/MF $0.50

The MUSE system, an IBM 7090 computer program and associated conversion equipment, has been designed for use as a sound synthesizer. Concise descriptions of complex sounds including human speech are converted by the MUSE system into sound pressure waveforms. The inputs to the MUSE system are specifications of the changing resonance frequencies of multiple acoustic filter networks and of the changing frequencies and amplitudes of the sources of acoustic energy that excite those networks. The output of the MUSE system is a sampled waveform calculated for each resonance by the solution of a second-order difference equation. The results are summed over a single system of resonances and then the resonance systems are also added together. The resulting string of sampled waveform ordinates is written in digital form on magnetic tape. Conversion to a voltage waveform is accomplished by use of the standard IBM 729 IV tape transport unit and a simple digital-to-analog converter. Although the quality of the sound is somewhat degraded by tape wow and flutter, acceptable and highly intelligible speech has been synthesized. Author (TAB)

N66-26312# Institut National des Techniques de la Documentation, Paris (France).

ON THE THEORETICAL BASIS OF INFORMATION RETRIEVAL SYSTEMS Final Report

Eric De Grolier Oct. 1965 214 p refs

(Contract AF 61(052)-505)

(AFOSR-65-2720; AD-628183) CFSTI: HC $6.00/MF $1.25

This report is an extensive survey of a commentary on research and developments in the fields of information retrieval and linguistics and the applicability of results to the formulation of information retrieval languages and machine translation. Commentary is weighed toward imparting an awareness of many of the special requirements of a reasonably efficient IR language, the complexities involved in translating from one language to another (be it natural language, IR language, or other synthetic languages), and the difficulties inherent in describing concepts and representing meanings. Real and putative relations which have been made between logic, linguistics, and information retrieval are explored in some detail. An extensive discussion is included of classification from a theoretical point of view, under topic headings: classifications of language; traditional bibliographic classifications; the British classification research group; Ejnar Wahlin's system; Gardin's Syntol; the problem of categories in classifications; the 'integrative levels' approach; and the problem of 'relations.' Activities in the United States, Europe, and the Soviet Union are considered. Author (TAB)

N66-26371# Space Technology Labs., Inc., Redondo Beach, Calif.

ESPOD FUNCTIONAL DESCRIPTION

Bedford, Mass., AFSC, Electron. Systems Div., 24 Jun. 1964 39 p refs

(Contract AF 19(628)-594)

(STL-8497-6067-RU-000; ESD-TDR-64-393; AD-602108) CFSTI: $3.60

ESPOD is a general orbit determination program prepared for use by the SPACETRACK/SPADATS Center, Ent Air Force Base, Colorado Springs, Colorado. Its primary purpose is to determine satellite orbits. It determines the elements of a satellite orbit and a covariance matrix of uncertainty in the determination, starting from some initial estimate of these elements and correcting it in accordance with observational data. It predicts the future position and velocity of the satellite from the best elements obtained. The program includes a unique collection of mathematical, statistical, and operational techniques to make it operate rapidly and automatically and to produce high precision in the results. Author (TAB)

N66-26377# General Electric Co., Washington, D. C.

THE APPLICATION OF LARGE SCALE COMPUTERS TO U. S. AIR FORCE INFORMATION SYSTEMS Final Report, 15 Jan. 1965–15 Jan. 1966

John B. Campbell, John P. Mc Cabe, and Essie S. Nevans Bedford, Mass., AFSC, Electron. Systems Div., Mar. 1966 77 p refs

(Contract AF 19(628)-4963)

(ESD-TR-66-137; AD-629867) CFSTI: HC $7.60/MF $0.75

Two Air Force functions were examined to determine the feasibility of centralizing the tasks at a computer center with remote access. The applications examined: (1) an overall pay system, and (2) a system to aid in the assignment of personnel to jobs, proved interesting in their demands upon large-scale data-handling and manipulation capabilities. Feasibility of both the pay and man–job match systems was shown and each was examined as a time-sharing type of application. The generalized time-sharing model showed centralization of all computational power to be more economical than distributing logical capability to remote stations. Three supporting analytic studies were performed. The first deals with a means for partitioning a large file to permit, in some cases, greatly reduced searching times. The second deals with a mathematical model for a time-shared computer system which allows for analytical calculation of processing times at each terminal as a function of system loading. The third investigates three computational algorithms for performing man–job match calculations. Estimates of processing times are given, and the methods compared. Author (TAB)

N66-26381# Systems Development Corp., Santa Monica, Calif.
BOUNDED REGULAR SETS Interim Scientific Report
Seymour Ginsburg and Edwin H. Spanier 12 Jan. 1966 14 p refs *Its* Sci. Rept.-9
(Contract AF 19(628)-5166)
(TM-738/024/00; AFCRL-66-127; AD-630424) CFSTI: HC $1.00/MF $0.50

Two characterizations of bounded regular sets are given. In addition, certain bounded regular sets are related to their commutative closure. Author (TAB)

N66-26415# International Business Machines Corp., Bethesda, Md.
DISCRIMINANT ANALYSIS FOR CONTENT CLASSIFICATION Final Report, Nov. 23, 1964–Nov. 22, 1965
John H. Williams, Jr. Griffiss AFB, N. Y., RADC, Feb. 1966 283 p refs
(Contract AF 30(602)-3563)
(RADC-TR-66-6; AD-630127) CFSTI: HC $6.00/MF $1.00

A series of experiments was performed to investigate the effectiveness and utility of automatically classifying documents through the use of multiple discriminant functions. Classification is accomplished by computing the distance from the mean vector of each category to the vector of observed frequencies of a document and assigning the document to the category having the highest probability. Data concerning the effect of the principal classification parameters on classification performance is reported, based on a data base of approximately 2700 abstracts from the solid state physics field. The parameters studied were the number of sample documents required to define a category, the length of documents, the interrelationship of the number of sample documents and their lengths, the relation of the number of word types in a document to the number of categories assigned to it, levels in a structure, homogeneity of categories, and performance measures. A higher performance level was obtained when samples of 140 documents were used to define each category than with samples of 35 and 70 documents. Classification results obtained on independent test sets of documents ranged from 73 to 92 percent. The test sets contained 419 and 1333 documents. Results are also reported in terms of Swets' effectiveness measure and Cleverdon's ratios of relevance, recall and precision. Author (TAB)

N66-26447# Sandia Corp., Albuquerque, N. Mex.
THE STRESS POSTPROCESSOR
C. R. Martell Dec. 1965 82 p ref
(Contract AT(29-1)-789)
(SC-RR-65-548) CFSTI: HC $3.00/MF $0.75

Computer routines are described which can be used with the APT system to obtain weights, centroids, and inertias as well as static and dynamic stress analysis information of solids of revolution. Also, areas, centroids, and inertias of plane areas can be obtained. Author (NSA)

N66-26494# System Development Corp., Santa Monica, Calif.
MAPPINGS WHICH PRESERVE CONTEXT SENSITIVE LANGUAGES Scientific Report No. 3
Seymour Ginsburg and Sheila A. Greibach 27 Oct. 1965 32 p refs
(Contract AF 19(628)-5166)
(TM-738/018/00; AFCRL-66-62; AD-629309) CFSTI: HC $2.00/MF $0.50

A basic result which gives a condition under which a (possibly length-decreasing) homomorphism preserves a context sensitive language is presented. Using this result, conditions under which pushdown transducers and linear bounded transducers preserve context sensitive languages are given. The basic result is also applied to show that certain rewriting systems generate context sensitive languages instead of arbitrary recursively enumerable sets. Of special interest is the result that if each rule in a rewriting system has a terminal letter of its right side, then the language generated is context free. Author (TAB)

N66-26526# RAND Corp., Santa Monica, Calif.
PROBLEMS OF ALGORITHMIC COMPOSITION OF SUBJECT INDEXES Brief Survey of Foreign Literature
B. V. Iakushin 15 Mar. 1966 18 p refs Transl. into ENGLISH from Nauchno-Tekhn. Inform. (USSR) no. 5, 1965 p 22–25
(LT-65-102; TT-66-60760; AD-629910) CFSTI: HC $1.00/MF $0.50

Major trends in developing methods of machine assignment of subject indexes are examined. Two approaches are discernible: (a) the use of subject descriptors based on key words extracted from the document (usually from the title); (b) the use of predetermined subject categories under which documents are indexed. It is noted that the systems that rely on statistical characteristics of the appearance of key words in the documents are the more promising. Author (TAB)

N66-26574# Lincoln Lab., Mass. Inst. of Tech., Lexington.
HAYSTACK POINTING SYSTEM: AUXILIARY REAL-TIME PROGRAMS
J. D. Drinan, ed. 31 Jan. 1966 150 p refs *Its* Tech. Note 1966-6
(Contract AF 19(628)-5167)
(ESD-TDR-66-21; AD-629936) CFSTI: HC $14.60/MF $1.00

A description is given of ten non-major subprograms in the Haystack Pointing System. These programs all operate in the real-time environment, but in a sense are embellishments to the system proper inasmuch as they are by design either utilitarian to system operation or perform minor system functions. The additional system capabilities provided by this set of subprograms include: alteration of memory locations; modification of certain system parameters; constant monitoring of selectable memory locations; pointing of the antenna to any azimuth and elevation or right ascension and declination; outputting of certain planning information 'on-line'; strip chart recording; magnetic tape recording; high-speed printer interfacing and Westford/Millstone intersite coupling. Author (TAB)

N66-26607# Army Electronics Labs., Fort Monmouth, N. J.
SATURATION PROCESSING: AN OPTIMIZED APPROACH TO A MODULAR COMPUTING SYSTEM
William C. Cave and Robert M. Dunn Nov. 1965 24 p refs
(ECOM-2636; AD-625859) CFSTI: HC $1.00/MF $0.50

Saturation processing is an optimal method for allocating resources which are maintained in a redundant fashion throughout a modular computing system. Such a computing system is very desirable where organizational fexibility and gradual degradation are of importance. However, the problem of communications and control within such systems severly limits their practicality. Saturation processing is an optimized approach to these problems, seeking to take maximum advantage of a modular computing system. The logical framework for a modular computing system utilizing only two

module types is described. Discussion of communications and control are given for this system using saturation processing. These discussions are augmented with methods and examples which point out a distinct reduction of these problems. Some conclusions are derived which indicate an inverse relationship between redundance of resources and required amount of executive control. Author (TAB)

N66-26694*# Brown Engineering Co., Inc., Huntsville, Ala.
THE GENERAL FUNCTIONAL RELATIONSHIP LANGUAGE SYSTEM
30 Jun. 1964 39 p refs
(Contract NAS8-11027)
(NASA-CR-75034) CFSTI: HC $2.00/MF $0.50 CSCL 09B

This report presents a symbolic language for expressing functional relationships in space vehicle systems. It defines and illustrates the methods of presentation and use of the General Functional Relationship Language System. Author

N66-26718# Air Force Cambridge Research Labs., Bedford, Mass. Data Sciences Lab.
M-460 PROGRAM NOTES: SOME LISP ROUTINES FOR MANIPULATING AUTOMATA
Thomas V. Griffiths Feb. 1966 38 p refs *Its* Phys. and Math. Sci. Res. Paper No. 192
(AFCRL-66-84; AD-630610) CFSTI: HC $2.00/MF $0.50

The report documents a set of LISP routines for manipulating finite-state machines. Though most of the LISP routines defined perform classical automata constructions, there are some routines operating on a non-deterministic version of a machine similar to the generalized sequential machine. A users' manual is included for the routines. Author (TAB)

N66-26722# Radio Corp. of America, Princeton, N. J.
CRYOELECTRIC RANDOM ACCESS MEMORY, PHASE III Final Report, 1 Mar. 1964–31 Aug. 1965
L. L. Burns Griffiss AFB, N. Y., RADC, Nov. 1965 387 p refs
(Contract AF 30(602)-3090)
(RADC-TR-65-405, Vol. I; AD-624606) CFSTI: HC $7.00/MF $1.75

A program is discussed for the development of a large capacity, random-access cryoelectric memory. Theoretical studies were undertaken on the cryoelectric memory. These studies showed that the detailed electrodynamic behavior of continuous film superconducting memories can be specified. It is shown that the most important single parameter is the uniformity of the grain structure in the tin memory film itself. Size variations greater than 2:1 of the microcrystallites of tin forming the memory film will make it practically impossible to build a plane with a uniformity of drive currents that is satisfactory for proper operation in a memory stack. Another important parameter is the geometrical control of the width of the drive and sense lines when other than cavity sensing techniques are used. It is shown that cavity sensing works quite satisfactorily for small structures, but is not usable for large structures. Two expressions were developed from different points of view that give essentially the same answer with regard to the variation in sense signal for cavity sensing structures over a plane. A practically exact solution to the output from a line sense structure is developed, and it is shown that a 1-mV sense signal can reasonably be expected for cryoelectric memory cells of a size such that 10,000 can be put in one square inch. The vortex theory of superconductive memories is fully developed and provides another method of attach in specifying the electrodynamic behavior of continuous film memory planes. Author (TAB)

N66-26724# California Univ., Berkeley. Operations Research Center.
TWO-STAGE LINEAR PROGRAM UNDER UNCERTAINTY: A BASIC PROPERTY OF THE OPTIMAL SOLUTION
Katta G. Murty Feb. 1966 16 p refs
(Contracts Nonr-222(83); DA-31-124-ARO-D-331; Grant NSF GP-4593)
(ORC-66-4; AD-630620) CFSTI: HC $1.60/MF $0.50

The two-stage linear program under uncertainty proposed by George B. Dantzig and developed by A. Madansky, A. Williams, Roger Wets and R. Van Slyke is considered. Roger Wets has shown that the set of feasible solutions to a linear program under uncertainty is a convex polyhedron, and the objective function to be minimized is a convex function. In this paper the author shows that there exists an optimal solution to the linear program under uncertainty in which the column vectors corresponding to the positive first-stage decision variables are linearly independent. This leads to the result that there exists an optimal solution in which not more than $m+\overline{m}$ of the first-stage decision variables are positive. Author (TAB)

N66-26745# National Aeronautical Lab., Bangalore (India).
TEMPORARY STORAGE CHECK UNIT FOR NAL DATA SYSTEM
S. Nagabhushana and A. Krishnan Dec. 1965 14 p
(TN-SE-8-65) CFSTI: HC $1.00/MF $0.50

A check unit for the temporary storage unit of the NAL data system has been built. This enables quick testing of printed cards of the temporary storage unit for all modes of operation. A quick-look table enables location of a faulty component from a list of failures in the tests. Author

N66-26776# European Atomic Energy Community, Brussels (Belgium).
FORTRAN INPUT–OUTPUT PACKAGE IN TRAP-MODE
J. Pire and L. Sangermano Mar. 1966 24 p In FRENCH; ENGLISH summary
(EUR-2760.f) CFSTI: HC $2.00/MF $0.50

F.I.O.T. is a system of read–write subroutines for the IBM 7090 computer, working in trap-mode and compatible with Fortran II version 3. Programmers wishing to use F.I.O.T. have to bring only a few modifications to their programmes written in Fortran. The gain of time stated by applying this system to different programmes not especially written for the use of F.I.O.T. is of about 15%. Author

N66-26786# Oak Ridge National Lab., Tenn.
A PROGRAM TO COMPUTE THE CLASSICAL DEFLECTION FUNCTION
M. H. Lietzke and M. G. Menendez Feb. 1966 44 p refs
(Contract W-7405-ENG-26)
(ORNL-3881) CFSTI: HC $3.00/MF $0.50

A computer program was written which may be useful in the interpretation of (in terms of classical mechanics) angular distributions measured in experiments on molecular beam scattering. The program is written in two parts: the first part is used to adjust the minimum value of the interatomic potential to any desired equilibrium internuclear distance by adjusting the strength of the repulsive portion of the potential, while the second part computes the classical

deflection function, the corresponding phase shift, and the angular spacing between the principal rainbow and the second order rainbow. The program is written in both ALGOL and FORTRAN II. Author (NSA)

N66-26786# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
MACABRE
M. L. Griebenow and K. R. Dickey Nov. 1965 54 p
(Contract AT(10-1)-205)
(IDO-17096) CFSTI: HC $3.00/MF $0.50

MACABRE is a series of codes for the IBM 7040 computer; it is capable of solving the isothermal hydraulics and the nonisothermal hydraulics and heat transfer characteristics of most plate-type reactor fuel elements cooled by pressurized water in forced convection. MACABRE is employed in ATR and EOCR fuel element analyses. Author (NSA)

N66-26798# Argonne National Lab., Ill.
APPLIED MATHEMATICS DIVISION SUMMARY REPORT, JULY 1, 1964–JUNE 30, 1965
[1965] 53 p refs
(Contract W-31-109-ENG-38)
(ANL-7129) CFSTI: HC $3.00/MF $0.50

The computer programs that were prepared during the period are summarized, together with developments in programming and computer systems. Some applications of computers to specific problems are outlined. NSA

N66-26817*# Alabama Univ., University. Bureau of Engineering Research.
A NONLINEAR ENCODER Technical Report No. 1, 9 May–9 Sep. 1964
Harold Mott and Chester C. Carroll Sep. 1964 23 p refs (Contract NAS8-5341)
(NASA-CR-75311) CFSTI: HC $1.00/MF $0.50 CSCL 09B

A time-base encoding system is described which can be adapted to high precision without reaching a point of inaccurate digital representation of the reference voltage. The system uses a sinusoidal reference voltage and a counter which is capable of accumulating pulses in such a way that the encoder output is an accurate digital representation of the reference during the encoding interval. There is no need for sample and hold circuitry in this particular encoder. The design of the comparator, the clock inhibit circuit, and the nonlinear counter are discussed. Author

N66-26853*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TAPE GENERATION PROGRAM (USERS' MANUAL)
Richard C. Lee May 1966 69 p
(NASA-TM-X-55489; X-564-66-220) CFSTI: HC $3.00/MF $0.75 CSCL 09C

This document describes the various features of the program for the UNIVAC 1107 which simulates satellite telemetry tapes derived from the STARS data processing lines. Also described are the input cards necessary to make use of the features. The file structure and data curve definitions are made by input parameter. The tape label and all parts of the frame format are optional. These optional features, defined by input paramters, make the program fexible enough to simulate almost any tape with fixed length records. Also included is a summary of possible input for the user already familiar with the program. R.N.A.

N66-26880*# Westinghouse Electric Corp., Baltimore, Md. Surface Div.
A COMPUTER PROGRAM FOR THE SIMULATION OF FAILURE-RESPONSIVE SYSTEMS Technical Report No. 6
J. M. Hannigan Apr. 1966 131 p ref
(Contract NASw-572)
(NASA-CR-75277; WGD-38521) CFSTI: HC $4.00/MF $1.00 CSCL 09B

A generalized computer simulation program was developed to facilitate a Monte Carlo approach to the reliability analysis problem. The simulation program may be employed in the analysis of failure responsive systems, multiple line systems, and other modularly redundant systems. A complete description of the program is presented, including input data format, output information, a descriptive list of program variables, detailed flow diagrams, and Fortran IV program listing. N.E.N.

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N66-25410# India. Dept. of Atomic Energy, Bombay. Electronics Div.
A STAGE AND AUDITORIUM LIGHTING SYSTEM WITH INCANDESCENT LAMPS
S. N. Seshadri 15 Jun. 1964 18 p refs
(AEET/ED/SG/20) CFSTI: HC $1.00/MF $0.50

This report describes an experimental stage and auditorium lighting system, developed for future use in the TIFR auditorium. The system is capable of controlling 500 watts of power at an output voltage of 110 volts. The system essentially consists of two units: (1) the power unit; (2) the controller unit. The operation of these units is examined in order. Author

N66-25428# Instituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
A TUNNEL DIODE COINCIDENCE CIRCUIT [UN CIRCUITO DI COINCIDENZA A DIODI TUNNEL]
C. Felici 5 Nov. 1965 33 p refs In ITALIAN; ENGLISH summary
(ISS-65/42) CFSTI: HC $2.00/MF $0.50

The present report deals with a double or triple coincidence circuit (it is also possible to add an anticoincidence channel) based upon the characteristics of a fast and precise tunnel diode trigger circuit. The circuit has, in addition, an input amplitude discriminator and pulse former. The most important characteristics of the circuit are: very high frequency working capability, continuously adjustable time resolution, and amplitude discrimination in each input channel without loss of resolution. Author

N66-25509# Piezo Crystal Co., Carlisle, Pa.
QUARTZ CRYSTAL UNITS, FILTER LOW FREQUENCY, 1 MC TO 10 MC, TYPES CR-(XM-49)/U THRU CR-(XM-52)/U

A. S. Matistic 14 Feb. 1966 23 p
(Contract DA-36-039-AMC-03635(E))
(QPR-6; AD-629913) CFSTI: HC $1.00/MF $0.50

In the search for a solution to complex technical problems with the mass loading technique at frequencies 5 mc and 6 mc, three series of crystal designs were progressively introduced to uncover the role of other factors besides plateback in the suppression of unwanted modes. Although conventional crystal processing techniques were adequate to resolve problems at the 6 mc frequency, unconventional processing was required to achieve comparable progress at the 5 mc frequency. These fabricating techniques are described in the report. Parallel work effort, including the design and construction of plating masks and crystal mounts (for the high frequency vibration aspects of the PEM), is also described.
Author (TAB)

N66-25524# Clevite Corp., Cleveland, Ohio. Piezoelectric Div.
PRODUCTION ENGINEERING MEASURE FOR CERAMIC FILTERS Eleventh Quarterly Report, 30 Sep.–29 Dec. 1965
A. Lungo [1965] 23 p
(Contract DA-36-039-AMC-01471(E))
(Rept.-11; AD-629718) CFSTI: HC $1.00/MF $0.50

During this period small production lots of ceramic disks were successfully processed into tuned 4.3 Mc and 6.0 Mc resonators with the production fixtures developed under this contract. Also, because of the low yield encountered, effort was directed toward the development of faster means of sorting resonators into groups with more restricted bandwidth and frequency characteristics.
Author (TAB)

N66-25543*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
DEVICE ANNEALING STUDIES Final Progress Report, 1 Apr.–30 Sep. 1964
J. Grossman [1964] 27 p
(Contract NAS5-2755)
(NASA-CR-74948) CFSTI: HC $2.00/MF $0.50 CSCL 09A

To develop an annealing process which can be used to achieve stable, high gain, bipolar transistors for very low power applications, experiments were performed on wafers that were given several diffusions to form transistors. Electrical tests showed that the transistors annealed at 700° and 750°C in air for one hour had a lower gain and were leaky compared with transistors allowed to cool faster in the controlled atmosphere. Experiments performed with hydrogen annealing produced transistors with high gains. The mixing of various percentages of hydrogen and nitrogen permitted the amount of gain increase to be controlled. The hydrogen and other annealing systems are described in detail. Transistors were given a lead oxide deposition and annealed. The lead glass helps to stabilize the transistor characteristics and even increase the gains of previously untreated transistors.
Author

N66-25611# Ballistic Research Labs., Aberdeen Proving Ground, Md.
AN ANALYTICAL APPROACH TO TRANSISTOR APPLICATION
Keats Pullen, Jr. Aug. 1965 21 p refs
(BRL-MR-1701; AD-630063) CFSTI: HC $2.60/MF $0.50

The solid-state equations defining semiconductor action in a transistor are shown to provide an analytic basis for the calculation of the behavior of a transistor in its circuit. Input and output relations and transfer relations are developed from these equations, and data on relative reliability of existing methods are developed. An example is presented which shows the ease and simplicity with which circuit design problems may be solved based on the approach. Author (TAB)

N66-25662# Defence Research Telecommunications Establishment, Ottawa (Ontario). Communications Lab.
A LOGARITHMIC IF AMPLIFIER FOR CW OR PULSE TYPE SIGNALS
F. R. Cross and D. C. Barnes Feb. 1966 21 p refs
(DRTE-1156) CFSTI: HC $1.00/MF $0.50

This report describes a 30 Mc amplifier, whose dynamic range of 110 dB is approximately logarithmic for all types of IF signals, including pulse signals of very short duration. Some characteristics curves that compare the operation of this amplifier with that of a linear type are presented.
Author

N66-25673# Pennsylvania State Univ., University Park. Ordnance Research Lab.
ANALYSIS AND DESIGN OF A MACHINE-SCAN ELECTRON BEAM DEVICE
R. B. Fair 8 Mar. 1966 85 p refs
(Contract NOw-65-0123-d)
(TM-630.3281-03; AD-630408) CFSTI: HC $3.00/MF $0.75

Electron beams can be used to perform a dual role in the fabrication of microcircuits. An electron source may be pulsed to provide a beam capable of machining materials, or alternately, to provide a low current beam for scanning electron image formation. If the beam is pulsed to high and low intensities at a sufficiently fast rate, it is possible to obtain a continuous picture of a bombarded specimen being machined. This paper presents the results of a study concerned with the design of a machine-scan electron beam device to perform the above operation. Theoretical calculations are coupled with experimental observations in order to design a suitable device, and a performance analysis on this apparatus is presented. The recommendations deal specifically with improvements on the device for further research.
Author (TAB)

N66-25843# Stanford Research Inst., Menlo Park, Calif.
RESEARCH ON DIELECTRICS FOR MICROWAVE ELECTRON DEVICES Final Report, 1 Oct. 1964–31 Oct. 1965
L. Feinstein, J. Bordeaux, D. Peters, and C. Peltzer Feb. 1966 93 p refs *Its* Rept.-13
(Contract DA-28-043-AMC-00215(E); ARPA Order 318-62; Proj. Defender)
(FMU-5195; AD-629942) CFSTI: HC $3.00/MF $0.75

High purity, vacuum sintered polycrystalline aluminum oxide was fabricated. This material is transparent and has a density that is 99.5% of theoretical. Further measurements of the properties of aluminum oxide show its actual high temperature electrical conductivity to be about five orders of magnitude less than previously reported. This discrepancy is due to conductivity of ionized gases surrounding the specimen and electron emission of electrodes. Space-charge-limited current studies of sapphire indicate the existence of trapping centers at 2.5 ev below the conduction band, which is probably due to impurity levels. Studies indicate that the properties of aluminum oxide are not sensitive to effects of radiation. Optical absorption studies lead to the conclusion that the bandgap of aluminum oxide is about 8.5 ev. The breakdown strength of polycrystalline aluminum oxide with glassy phase is similar to that of bent single crystal specimens, i.e., less than that of the single crystal material. Electron bombardment of single and

polycrystalline materials produces the same type of response, which is relatively independent of the morphology of the dielectric. Internal polarization due to heterogeneous charge distribution can be generated by electron bombardment. TAB

N66-25862# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
GATE RING COUNTERS AND THEIR POSSIBLE ADVANTAGES IN LOW POWER MICROELECTRONIC SYSTEMS Final Report
George J. Veth Nov. 1965 32 p
(Contract NOw-62-0604-c)
(TG-741; AD-630038) CFSTI: HC $2.00/MF $0.50

Cascade and ring counters are frequently found in microelectronic systems because binary counter stages composed of flip-flops having appropriate pulse steering networks have been easily realized in semiconductor microelectronic form. Other arrangements, however, are superior in flexibility and power dissipation, but they are not realizable in semiconductor microelectronic form because of present limitations in semiconductor microelectronic fabrication capabilities. Gate ring counters are realizable, though, and they offer capabilities not available with cascade and ring counters. Nor and nand gate ring counters are discussed and compared with cascade and ring counters employing binary counter stages. Author (TAB)

N66-25886# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
PRODUCTION ENGINEERING MEASURE FOR A GERMANIUM PNP POWER TRANSISTOR Second Quarterly Progress Report, 14 Jul.–14 Oct. 1965
Dan Sullivan and Paul Greer [1965] 121 p
(Contract DA-36-039-AMC-06161(E))
(G-16; AD-629893) CFSTI: HC $4.00/MF $0.75

This report covers the engineering investigations conducted during the report period designed to improve the reliability yields and parameter distributions of the SP-188H germanium power PNP transistor. Results not previously reported are included. Author (TAB)

N66-25921# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RAPID-ACTION SWITCH FOR 30-CENTIMETER WAVE
A. F. Bachurin 3 Mar. 1966 23 p refs Transl. into ENGLISH from Izv. Krym. Astrofiz. Obs. (Moscow), v. 32, 1964 p 187–191
(FTD-TT-65-1305/1+2+4; AD-630280) CFSTI: HC $1.00/MF $0.50

A model mechanical double-pole switch on coupled resonators is described and its characteristics given. The switch can be used as a modulator in radiometers. Author (TAB)

N66-25941# MSI Electronics, Inc., Richmond Hill, N. Y.
RESEARCH AND DEVELOPMENT OF AN ELECTRO-OPTIC WIDEBAND SPECTRUM ANALYZER Quarterly Report, 16 Nov. 1965–31 Jan. 1966
A. Lederman et al 15 Feb. 1966 22 p refs
(Contract NObsr-95080)
(QR-1; AD-630050) CFSTI: HC $2.60/MF $0.50

Test equipment is being assembled to perform a single-frequency detection experiment. Preliminary tests at RF show that a dielectric structure will match the electro-optic crystal into X-Band waveguide, and various artificial dielectrics are being tested for use in this design. An optical discriminator is being made, together with its photodetector, to integrate with the waveguide electro-optical portion of the spectrum analyzer. Analysis of the optical discriminator system shows good broadband performance with sensitivity falling off only 5% at each extreme of the 8 to 12 Gc band. Author (TAB)

N66-25954# Radio Corp. of America, Princeton, N. J.
ACTIVE LOGIC ELEMENTS USING NON-GALVANIC MODIFYING INPUTS Final Report, Oct. 1, 1964–Sep. 30, 1965
Gerald Herzog, Joseph Guarracini, and Robert A. Powlus Mar. 1966 33 p refs
(Contract AF 19(628)-4387)
(AFCRL-66-29; AD-630022) CFSTI: HC $2.00/MF $0.50

A logic array of 128 MOS transistors was constructed that has the ability to operate as a half-adder, a ring oscillator with any odd number of stages up to 15, a group of coupled flip-flops or any one of many other special configurations. The desired logic network is specified by an optical radiation pattern determined by the holes punched in a standard business data card. Photoconductors sense the radiation and turn on MOS transistors that close the signal paths between MOS transistor-NOR gates. The logic performed therefore depends on which paths are closed between the various NOR gates. Insulated-gate field-effect transistors (IGFET) of the metal-oxide-semiconductor (MOS) variety were selected for this use because of the small amount of energy required to control their conduction. Experiments with thin-film versions of the IGFET indicate equivalent usefulness and the promise of large low-cost modifiable arrays of logic gates. Author (TAB)

N66-25987# Stanford Univ., Calif. Linear Accelerator Center.
A SUBNANOSECOND COINCIDENCE CIRCUIT
Arpad Barna Dec. 1965 70 p refs
(Contract AT(04-3)-515)
(SLAC-52) CFSTI: HC $3.00/MF $0.75

A coincidence circuit with a resolving time of 0.3 nsec is described. An evaluation of the performance of the circuit is summarized in which a pulsed light source and two photomultipliers were used. An analysis of the performance of the circuit is also included. NSA

N66-26037# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
A LARGE COAXIAL, LITHIUM-DRIFT GERMANIUM DIODE FOR GAMMA-RAY SPECTROSCOPY
A. J. Tavendale Sep. 1965 14 p refs Presented at Conf. on Nucl. Phys., Melbourne, 23–25 Aug. 1965
(AAEC/TM-299; CONF-650839-1)

A "single-ended," coaxial, lithium-drift germanium diode with an active volume ~30 cm^3 (1.8 $in.^3$) was fabricated and tested as a high resolution γ-ray spectrometer. Leakage currents at liquid nitrogen temperatures (77°K) were $<1\times 10^{10}$ amp up to 1000 v reverse bias. Diode junction capacitance was 42 pF. Resolutions (FWHM) of 4.3, 5.5, and 8.7 kev were obtained on the full-energy peaks from γ-rays at 122-, 1333-, and 2614-kev energy respectively. Intrinsic full-energy peak efficiencies were 8.4, 3.1, and 2.3% at 511-, 1333-, and 1840-kev γ-ray energy respectively for a source-to-detector distance of 10 cm (axial irradiation). γ-ray pulse rise times (10–90% levels) were ~50–100 nsec and pulser rise time was 30 nsec at 1000 v bias. The performance of this large detector at high γ-ray energies was characterized by a

high full-energy peak to Compton background ratio; a peak to Compton ratio of 5:1 was measured at 2614-kev γ-ray energy. Author (NSA)

N66-26087# Joint Publications Research Service, Washington, D. C.

A STABILIZED HIGH-VOLTAGE RECTIFIER

G. A. Fedotov *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 1–3 refs (See N66-26086 14-14) CFSTI: $6.00

The article examines a high-voltage stabilizing rectifier with a small ripple ratio and a high stability of the output voltage. Current conversion is utilized in the circuit arrangement. Author

N66-26091# Joint Publications Research Service, Washington, D. C.

AN EXAMINATION OF A MAGNETIC-AMPLIFICATION LINEAR-DISPLACEMENT PICKUP WITH A PERMANENT MAGNET AND ITS ERRORS

O. A. Korzhavin and L. F. Kulikovskiy *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 25–33 refs (See N66-26086 14-14) CFSTI: $6.00

A linear-displacement pickup is examined in the article, which represents a combination of an inductive pickup and magnetic amplifier with a common magnetic system as a base. Such a combination makes it possible to increase the output power to a magnitude sufficient for termination directly at a recording device. The design and experimental investigation of the pickup are given. Author

N66-26092# Joint Publications Research Service, Washington, D. C.

THE DESIGN OF ELECTRONIC SWITCHING CIRCUITS FOR PARAMETRIC CONVERTERS

V. I. Pakhomov *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 34–39 refs (See N66-26086 14-14) CFSTI: $6.00

In designing systems for centralized gathering of information, it is stated that a problem exists in the standardization of the input quantities, and that system reliability is reduced because existing standardizing devices usually consist of a large number of elements. This article discusses the design of simplified electronic switching circuits for parametric converters. The circuits considered are shown in diagrams, and equations are derived for evaluating the errors in the proposed system. H.S.W.

N66-26095# Joint Publications Research Service, Washington, D. C.

A MAGNETIC AMPLIFIER WITH A HIGH LINEARITY OF THE CHARACTERISTIC

N. M. Perevozchikov *In its* Izv. VUZov: Instru. Bldg., No. 6 12 May 1966 p 51–54 refs (See N66-26086 14-14) CFSTI: $6.00

The article examines the operation of the circuit of a differential magnetic amplifier with a series galvanic negative feedback. The input-output characteristics and the input resistance of the circuit are determined. Author

N66-26096# Joint Publications Research Service, Washington, D. C.

THE APPLICATION OF GENERALIZED CHARACTERISTICS FOR THE ANALYSIS OF DIFFERENTIAL MAGNETIC AMPLIFIERS

N. M. Yakovlev *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 55–61 refs (See N66-26086 14-14) CFSTI: $6.00

A method is discussed in which generalized characteristics are used to determine the amplitude and phase of the first harmonic of the load current of a differential magnetic amplifier. A circuit diagram of the amplifier considered is shown and the equations which define the steady state operation of the amplifier load circuit are given. The formulas for this determination are derived and the method is applied to a specific example. It is stated that this method may also be used to obtain the characteristics of a bridge circuit. H.S.W.

N66-26112# Joint Publications Research Service, Washington, D. C.

NON-STEADY STATE OF THE HEATER-TYPE RESISTORS

V. M. Geller and Z. I. Zelikovskiy *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 159–164 refs (See N66-26086 14-14) CFSTI: $6.00

The non-steady state operation of metal thermistors with indirect heating is examined. One of the basic assumptions advanced is that overheating is slight and does not lead to a substantial change in the parameters of the boundary layer of the medium surrounding the working elements of the heater-type resistor. The differential equations which describe the system considered are given and expressions which define the rate of thermal heating for three separate conditions are derived. H.S.W.

N66-26148*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

AN AMPLIFIER FOR USE WITH SOLID STATE RADIATION DETECTORS IN SPACECRAFT APPLICATIONS

J. H. Marshall 30 Oct. 1964 23 p refs

(Contract NAS7-100)

(NASA-CR-74885; JPL-TM-33-190) CFSTI: HC $1.00/MF $0.50 CSCL 09A

A charge-sensitive amplifier for use with solid state radiation detectors is described. Particular emphasis is placed on an analytic design approach so that optimal gain stability and resolution can be obtained for a minimum of weight and power. Measured results for an amplifier constructed for laboratory use are presented for comparison with the theoretical analysis. Presently this amplifier is being used in the second-generation alpha scattering experiment on Surveyor. Author

N66-26153# Joint Publications Research Service, Washington, D. C.

RELATIONSHIP BETWEEN THE EROSION OF BIMETALLIC ELECTRODES AND THE PLACE WHERE THE DISCHARGE BEGINS

I. G. Nekrashevich and I. A. Bakuto *In its* Electron. Treat. of Mater. 2 May 1966 p 16–20 refs (See N66-26150 14-34) CFSTI: $4.00

This article presents a quantitative examination of the relation between bimetallic electrode erosion and the initial point of discharge. The extent of erosion was determined by weighing each electrode before and after a series of discharges. The area of the craterlets was determined by planimetring the magnified images. Results of the measurements are shown graphically. The study established that the extent of erosion of the bimetallic electrode can be expressed by a linear relationship. The same conclusion was derived by

plotting a respective curve based on the experimental data. This indicates that the results can be explained by the migration theory. R.N.A.

N66-26205# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
RESEARCH AND DEVELOPMENT ON SILICON CARBIDE ACTIVE DEVICES Final Report
H. C. Chang Oct. 1965 97 p refs
(Contract AT(30-1)-3405)
(NYO-3405-4) CFSTI: HC $3.00/MF $0.75

Research is presented towards the development of junction-gate type unipolar field-effect transistors from silicon carbide which are capable of operating at 500°C in a radiation environment containing gamma rays; and slow and fast neutrons. The transistor designs are based on both abrupt and graded junction theories. A detailed mathematical and computer analysis of the graded junction design is given which approximates more closely the present state-of-the-art aluminum diffused junctions in silicon carbide than the original abrupt junction treatment by Shockley. The thermal growth of SiO_2 on SiC and the chlorine etching of SiC were studied, and the oxidation and etch rates determined. A self-masked diffusion technique was developed which utilizes SiO_2 as a mask for selectively etching regions for aluminum diffusion. This technique can provide precise control in making the device configuration. Preliminary radiation-damage studies with fast and slow neutrons indicate that a SIC unipolar transistor should be operable up to an intergraded neutron flux level of 10^{16} nvt or greater at 500°C. NSA

N66-26240*# Electro-Optical Systems, Inc., Pasadena, Calif.
HIGH TEMPERATURE ZERO DROP THYRATRON TUBE PROGRAM, PHASE I Final Report
W. J. Kearns 1 Feb. 1966 118 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951352)
(NASA-CR-74917; EOS-7016-Final-I) CFSTI: HC $4.00/MF $0.75 CSCL 09A

The development of a high temperature power conditioning system for a 150-watt thermionic converter generator is reported. This generator consists of thyratrons, a high temperature transformer, and associated circuitry. Two schemes were investigated: (1) high temperature, metal-ceramic thyratrons and a high temperature inverter transformer mounted adjacent to the thermionic converter generator to eliminate the need for high current bus bars from the generator to the load; and (2) high temperature ceramic thyratrons mounted directly behind the thermionic converter generator but connected to a low temperature transformer and grid circuit by high current bus bars. In both approaches, the thyratron cathode was heated by thermal energy from the generator cavity, the thermal energy absorbed by the thyratron being used to provide electron emission and work function adjustment to effect zero-drop operation. C.T.C.

N66-26245*# Texas Instruments, Inc., Dallas.
STUDY OF SOLID-STATE INTEGRATED MICROWAVE CIRCUITS Scientific Report No. 1, 15 Sep.-14 Dec. 1965
31 Dec. 1965 170 p refs
(Contract NAS12-75)
(NASA-CR-71926; U4-811500-4) CFSTI: HC $5.00/MF $1.00 CSCL 09A

A study of solid-state microwave devices, techniques, and components associated with the 1- to 6-GHz frequency range is presented. The purpose is to determine the current state of the art of these active and passive devices when applied to integrated circuits. Separate sections of the report present material on: transistors; striplines; thin-films; lumped-constant circuits; other semiconductor devices, including varactors, PIN diodes, and Schottky barrier diodes; high dielectric constant materials; ferrites; and filters. Author

N66-26367# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
ELECTRON BEAM TECHNIQUES FOR FABRICATION AND ASSEMBLY OF PARTS FOR ELECTRON TUBES Tenth Quarterly Report, 1 Oct.-31 Dec. 1965
Marvin L. Kohn [1966] 39 p refs
(Contract DA-36-039-AMC-03625(E))
(EBR-183; AD-630001) CFSTI: HC $2.00/MF $0.50

The program objectives and a concise summary of the program history are presented. Progress during this reporting period relevant to manufacturing and evaluating preproduction and pilot line 6914 tubes and the completion of all activities and shipment of the 6544 tubes is discussed. Proposed objectives for the remainder of the program are outlined. Author (TAB)

N66-26406# Lewis (E. B.) Co., Inc., East Hartford, Conn.
PRODUCTION ENGINEERING MEASURE, CRYSTAL UNIT CR-(XM-46A)/U Quarterly Report, 1 Aug.-1 Nov. 1965
Robert P. Mc Comb [1965] 24 p
(Contract DA-36-039-SC-86737)
(QR-11; AD-631021) CFSTI: HC $1.00/MF $0.50

Conclusions: The measurements of parameters at 70 MC/s according to SCS-135A and Modification No. 7 can be accomplished. The systematic error involved in measurement results was clarified and a correlation established. The fabrication of the 70 MC/s units is critical as to the technique required to 'finish' the crystal units to frequency. The measurement of frequency and resistance deviation over the operating temperature range −55° to +90°C can be adequately and economically done if a coil is used in series with the crystal unit. Author (TAB)

N66-26408# Hughes Aircraft Co., Fullerton, Calif.
EFFECT OF TRANSISTOR DESIGN PARAMETERS ON RADIATION RESPONSE (POWER TRANSISTORS) Second Quarterly Report
Vincent R. Honnold, Gary D. Thomas, and Jerome J. Masenko Ft. Monmouth, N. J., Army Electron. Command, Apr. 1966 32 p refs
(Contract DA-28-043-AMC-01541(E))
(FR-66-17-106; ECOM-01541-2; AD-630836) CFSTI: HC $3.60/MF $0.50

The theory of irradiation data analysis is worked out in accordance with the techniques of the analysis of variance. The basic irradiation data consists of two sets of numbers associated with each design variation (treatment). The first set is the slope of the common base current gain as a function of fluence for a particular emitter current. The second set, which characterizes the response of a device to a pulse of ionizing radiation, is the maximum amplitude of the transient collector base leakage current produced by the pulse. In preparation for data analysis by digital computer, a double subscript notation is worked out, representing a particular design factor and a treatment number respectively, and is applied in the development of various sum-of-square expressions required for the analysis of variance. Author (TAB)

N66-26409# Hughes Aircraft Co., Fullerton, Calif.
EFFECT OF TRANSISTOR DESIGN PARAMETERS ON RADIATION RESPONSE (POWER TRANSISTORS) First Quarterly Report, 1 Jul.–30 Sep. 1965
Vincent R. Honnold, Gary D. Thomas, and Jerome J. Mazenko Ft. Monmouth, N. J., Army Electron. Command, Mar 1966 23 p refs
(Contract DA-28-043-AMC-01541(E))
(FR-66-17-105; ECOM-01541-1; AD-630835) CFSTI: HC $2.60/MF $0.50

The object is to determine design characteristics and fabrication techniques for a silicon planar power transistor that will minimize the effects of ionization and lattice displacement caused by high energy radiation. The experimental phase uses specially designed transistors in which various design variations have been included. Radiation testing of these transistors is in accordance with factorial design principles. The data are analyzed using the techniques of the analysis of variance. The theoretical effort is based on transistor physical design theory and is used to correlate and verify the results of experiment. Work during the first quarter consisted of the formulation of physical design theory including the effects of injection level. In addition, the sequencing of the fabrication steps for the 2N2369 was laid out in accordance with statistical design principles and transistor fabrication was initiated. Instrumentation design was completed and construction started on the circuits. Author (TAB)

N66-26410# Army Electronics Labs., Fort Monmouth, N. J.
EFFECTS OF FINITE BEAM SIZE ON THE NOISE FIGURE OF TRAVELING-WAVE TUBES IN HIGH MAGNETIC FIELDS
Bruno Zotter Feb. 1966 20 p refs
(ECOM-2669; AD-630598) CFSTI: HC $1.60/MF $0.50

The dependence of noise figure of traveling-wave tubes on magnetic fields is calculated in terms of a recently published method. This method shows that the relevant terms cancel out and that there is no first-order dependence. The negative result is explained as an inherent failure of this approach, which does not take into account two noncoherent noise sources. An alternate approach is suggested, using transformation properties of the electron beam capable of carrying four axially-symmetric waves. It is deduced that the transverse modes are cooled by high magnetic fields and that energy interchange between the purely longitudinal space-charge modes and the two purely transverse modes can occur. The detailed calculation of the energy interchange will be published in a forthcoming report. Author (TAB)

N66-26413# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
MULTILAYER BOARD APPLICATION TO RF CIRCUITRY
Mark Hurowitz and William E. Berg 24 Nov. 1965 46 p refs
(Contract DA-28-043-AMC-11379(E))
(EDL-M889; AD-629890) CFSTI: HC $2.00/MF $0.50

Investigation of miniaturization techniques suitable for a quick reaction facility was continued, and techniques developed during previous R and D programs were improved. Applications of miniaturization techniques to linear circuits in the very high and ultra high frequency ranges were made successfully. Extensive use of multiple-layer, printed wiring boards was made to maintain and update the state of the art in the laboratory. These boards were designed to fit into extrusions to give support and isolation to the circuit. Performance data are included in the report, with an analysis of the major components of the designs. Author (TAB)

N66-26414# Motorola, Inc., Scottsdale, Ariz. Military Electronics Div.
INTEGRATED CIRCUITS FOR COMBAT AREA EQUIPMENT Third Quarterly Progress Report, 1 Aug.–1 Nov. 1965
C. D. Shupe, R. T. Paca, and T. T. Monaghan 18 Jun. 1964 30 p
(Contract DA-28-043-AMC-01204(E))
(WP-3081-3; AD-629892) CFSTI: HC $2.60/MF $0.50

During the reporting period the fabrication of the four individual I/C chips of the I/C Range Gated Filter was in process. The status of the I/C, and the problems encountered in processing, are discussed. Author (TAB)

N66-26420# Army Electronics Labs., Fort Monmouth, N. J.
A COAXIAL CAVITY POWER AMPLIFIER (1300 TO 2400 MEGAHERTZ)
George C. Fincke, Jr. Mar. 1966 17 p
(ECOM-2679; AD-631054) CFSTI: HC $1.00/MF $0.50

A power amplifier of 50 watts power output, tunable from 1300 to 2400 megahertz, was designed and constructed for use with the power tetrode, type Z-5267. The single-ended coaxial amplifier has a power gain of 10 decibels ±1/2 decibel across the band at an instantaneous bandwidth of one percent and a plate efficiency of 25 percent. Double, noncontacting, one-quarter wavelength, 'bucket'-type choke, tuning plungers are used in both the input and output coaxial cavities. The overall size of the amplifier, including the tuning mechanisms, is 6.75 inches wide by 21.75 inches long. Design considerations and operating conditions are discussed. The Appendix contains lists of materials used and the numbers for the individual parts drawings. Author (TAB)

N66-26423# Army Electronics Labs., Fort Monmouth, N. J.
FERRITE CABLE CHOKES
Ernest T. Harper Mar. 1966 47 p refs
(ECOM-2675; AD-631053) CFSTI: HC $2.00/MF $0.50

A theoretical and experimental investigation was made of the factors affecting the performance of toroidal inductors with ferrite cores and windings of coaxial cable. Design procedures are developed and described for toroidal cable chokes which provide a specified minimum amount of rf isolation over a band of frequencies. It is shown how one may maximize the width of the frequency band for a given rf isolation impedance. The entire band, from 2 to 30 Mc, may be covered by a set of only three individual cable chokes, providing an rf isolation of better than 5,000 ohms. Author (TAB)

N66-26425# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
INTEGRATED CIRCUITS FOR FIELDATA COMPUTERS First Quarterly Report, Jul.–Sep. 1965
Ury Davidsohn and James Solomon Ft. Monmouth, N. J., Army Electron. Command, Mar. 1966 40 p
(Contract DA-28-043-AMC-01630(E))
(T-16; ECOM-01630-1; AD-631027) CFSTI: HC $2.00/MF $0.50

MATERIALS AND PROCESSES: Two dielectric isolation methods were explored for implementation of circuits. These are: (1) thermally grown silicon dioxide with a polycrystalline silicon matrix, and (2) glass isolation with a dummy silicon support slice. The latter technique appears most applicable because of still lower capacitances to the substrate. The glass isolation lends itself to the simpler implementation of beam-lead technology if desired. CIRCUITS: Emitter current-steered (ECL) and saturating high speed (TTL) circuit configurations

were explored, both with the view toward obtaining the required speed/power product. The circuits were also considered from the point of view of radiation hardening possibilities. The present activities are directed toward the use of the TTL logic function. Linear high frequency amplifier studies were performed and evaluations made as to implementation utilizing dielectric isolation techniques. Author (TAB)

N66-26441# Minnesota Univ., Minneapolis. Electron Tube Research Lab.
NOISE MEASUREMENTS AS A TOOL IN ELECTRON DEVICE RESEARCH Quarterly Progress Report No. 11, 1 Jul.–30 Sep. 1965
A. Van Der Ziel [1965] 67 p
(Contract DA-36-039-AMC-00028(E))
(Rept.-23; AD-629781) CFSTI: HC $3.00/MF $0.75

Equipment is being assembled for pulse noise measurements in thin film structures, including thin film cathodes. Equipment is also being assembled for noise measurements in transmission secondary emission image intensifier tubes obtained from Westinghouse. Improved techniques for making better, or novel, secondary emission targets have been introduced. Secondary emission noise measurements indicate that $\gamma\delta$=var $n_c/<n_c>$, where n_c is the number of secondaries produced by a given primary, varies as the square root of the primary energy over a rather wide primary energy range. There is therefore only a limited energy range for which var n_c is congruent to (n_c). Univac thin film Al_2O_3 diodes with about 20 Å oxide thickness show l/f noise, varying as I_e^2, at low frequencies and full shot noise at higher frequencies. There was no apparent space charge suppression of the noise. Screen noise measurements were performed on the highspeed screen of a 5BNP16 cathode ray tube. A circular scan was used to scan the screen and the light output was detected by a phototube. Both the resulting noise spectrum and the rms deviation from the mean photocurrent were measured. Interesting results were obtained that are not yet fully explained. Author (TAB)

N66-26443# Tung-Sol Electric, Inc., Livingston, N. J. Chatham Electronics Div.
HIGH SPEED POWER AMPLIFIER USING AN ELECTRON SWITCHED P-N JUNCTION Quarterly Report, 27 Nov. 1965–27 Feb. 1966
Nelson E. Ake [1966] 17 p
(Contract NObsr-93306)
(QR-3; AD-628858) CFSTI: HC $1.60/MF $0.50

A planar silicon dioxide passivated diode has been designed and fabricated for the EBM tube. The typical reverse electrical characteristics of the diode are a reverse voltage breakdown of 700–1000 volts with a maximum reverse leakage current of 3 micro amps at 600 volts reverse bias. The starting material is 'N' float zone bulk silicon with a resistivity in the range of 70–125 ohms-cm. Some difficulty was encountered in making a diode with a reverse voltage breakdown of 700 volts with starting material below approximately 125 ohms-cm. However, it has been demonstrated that diodes with reverse voltage breakdowns of greater than 700 volts can be made with starting material of 60 ohms-cm. Lower starting resistivity material provides a lower parasitic resistance in the device during the conduction cycle. It has been demonstrated that these diodes will remain good for extended periods under environmental conditions simulating the inside of a vacuum tube. Author (TAB)

N66-26488# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
SMALL SIGNAL FUNCTIONAL CIRCUITS Final Report, 1 Jul. 1964–30 Jun. 1965
James Feit and Robert Mc Ginnis Mar. 1966 95 p refs
(Contract DA-28-043-AMC-00150(E))
(ECOM-00150-F; AD-630690) CFSTI: HC $3.00/MF $0.75

A description is given of the design of silicon linear integrated circuits and of a 51-mc FM manpack communications receiver utilizing these circuits. The following items were developed: (1) RF amplifier—A low power drain integrated circuit capable of 15–18 db power gain at 51 mc. (2) Mixer—a low power drain integrated circuit capable of 20 db conversion gain as a first mixer and 28 db conversion gain as a second mixer. (3) First oscillator—a low power drain crystal-controlled integrated-circuit oscillator capable of providing sufficient oscillator injection at frequencies ranging from 36.3 mc to 46.3 mc. (4) Second oscillator—a low power drain crystal-controlled integrated-circuit oscillator capable of providing oscillator injection at 10.245 mc to the second mixer. (5) Integrated-circuit demonstration receiver—an FM receiver incorporating the above listed integrated circuits and other integrated circuits (AD-614 090). The demonstration receiver meets the AN/PRR-9 Manpack receiver electrical performance specifications with a significant reduction in receiver power drain. Author (TAB)

N66-26489# Hamilton Standard Div., United Aircraft Corp., Broad Brook, Conn. Electronics Dept.
MICROBONDS FOR HYBRID MICROCIRCUITS Fifth Quarterly Report, 1 Feb.–30 Apr. 1966
P. R. Amlinger and S. Rogers Feb. 1966 255 p refs
(Contract DA-36-039-AMC-03742(E))
(HSER-3117; AD-630948) CFSTI: HC $6.00/MF $1.25

Test results, statistical analysis, and failure modes of over ten types of split-tip welded microbonds between fine gold and aluminum wires (.0007, .002 and .005-in. dia.) to gold and aluminum films are discussed as well as bonding techniques for the newly emerging flip-chip devices. Reliable split-tip welded microbonds can be made between gold wires and films of gold/chromium or gold/nickel/molybdenum manganese on 'as-fired' alumina. The quantity of gold system microbonds on glass, glazed alumina, and oxidized silicon were statistically analyzed. A minimum of 15,000 Å of gold are required to obtain optimum microbonds. The optimum thickness of the fired-on Au-Ni-MoMn system was 0.001 inch. The sensitivity of glass and glazed alumina substrates to thermal shock adversely affected bond strength reliability. Gold system microbonds on oxidized silicon substrates could not be made meeting the full reliability requirements of the contract although a fair degree of reproducibility was demonstrated. Marginal or unsatisfactory microbonds were found between aluminum wire and Au/Cr or aluminum films regardless of substrate material. Author (TAB)

N66-26524# Sylvania Electric Products, Inc., Woburn, Mass. Semiconductor Div.
PRODUCTION ENGINEERING MEASURE (PEM) FOR SILICON VARACTOR DIODE Quarterly Progress Report, 1 Jul.–30 Sep. 1965
G. Bowne and R. Baylies [1965] 56 p
(Contract DA-36-039-AMC-06159(E))
(QPR-2; AD-625756) CFSTI: HC $3.00/MF $0.75

Group B test results have been completed on units from the First Engineering Test Sample Run. Process improvements evolved during the first and second quarters are described and have been incorporated in the Second Engineering Test Sample Run. The second run has been completed and devices are in the testing cycle. Author (TAB)

N66-26539# TRW Semiconductors, Inc., Lawndale, Calif. Research and Development Dept.
TRANSISTOR, VHF, SILICON, POWER (10W-500Mc) Final Report, 1 Jul. 1963–15 Jan. 1965
R. N. Clarke and J. Crishal [1965] 120 p refs
(Contract DA-36-039-AMC-03189(E))
(TRWS-59-RD-F; AD-622879) CFSTI: HC $4.00/MF $0.75

The transistor produces 10 watts at 500 mc with 5–6 db of power gain and 30–40% collector efficiency. The crystal was originally designed according to present power gain theory, but it only had one to two db of power gain at 500 mc. The second crystal design was based upon the smallest practical pattern dimensions, or a 0.1 mil minimum spacing. The redesigned pattern also had provision for analyzing the transistor in multiples of sub cells as well as in its entirety. Such an analysis showed the necessity of symmetry of base feed in common emitter amplifiers to get all the cells working together. Paralleling of cells also indicated an apparent loss in f_T with increased size. Processing and assembly was generally along standard industry practice except in the area of photoresist. There, improved glass masks were used, along with the new KTFR photoresist. Successful etching of fine metallized patterns was accomplished through the development of a jet etching technique. To retain as much of the innate crystal performance capability as possible, considerable work was done on packaging. It was concluded that no available package was truly adequate. The best available for the R.F. performance is the silicone molded package due to its short, low-loss lead. This package has a bonus of reliability and ruggedness as well as a large cost reduction in eventual production. Author (TAB)

N66-26562# Texas Instruments, Inc., Dallas.
THIN FILMS FORMED BY ELECTROCHEMICAL REACTIONS Eighth Quarterly Report, 1 Sep.–30 Nov. 1965
Michael J. F. Gaze and Joe P. Keene Feb. 1966 38 p refs
(Contract DA-36-039-AMC-02324(E))
(TI-03-66-10; ECOM-02324-8; AD-631034) CFSTI: HC $2.00/MF $0.50

The report summarizes work done on techniques for fabricating thin conductive, resistive and dielectric films by complete or partial oxidation of a suitable metallic film deposited in predetermined patterns and sequences. Investigation of the mechanism of the deposition process continued. A general law for the relationship between resistivity and time is expressed in logarithmic form. A study was made of the aging characteristics of deposited films. A large series of tests has begun in order to obtain information on the reactive-sputtered Ta_2O_5 dielectric. The 455 kHz amplifier test vehicle did not notch at the nominal frequency but rather at 1.5 MHz. Attempts were made to selectively etch reactively sputtered tantalum by back sputtering. The conclusions on work results are: (1) For a practical production process, a limit of about 500 ohms/square for sheet resistivity must be set; (2) Better control of the sputtering ambient gas is necessary; (3) Work on the 455 kHz amplifier has stopped pending further work on the M_nO_2 layer to reduce capacitor losses at high frequency; (4) Gold-doped resistors require further analysis to establish temperature coefficient of resistivity values and the maximum sheet resistance obtainable; and (5) Sputter etching is not applicable to the removal of heavily oxidized tantalum films from silicon oxide substrates. Author (TAB)

N66-26594# Radio Corp. of America, Lancaster, Pa. Industrial Tube and Semiconductor Div.
RESEARCH AND DEVELOPMENT OF HIGH RESOLUTION TELEVISION TUBES Interim Technical Report, 15 Sep.–15 Dec. 1965
17 Jan. 1966 24 p
(Contract AF 33(615)-3008)
(ITR-1; AD-626635) CFSTI: HC $1.00/1F $0.50

The tube being developed is based on the tube developed on Contract AF33 (615)-2109. The tube design was changed in order to correct some problem areas experienced on the previous contract. A new design for the vidicon section of the tube was studied with the objective of eliminating the field mesh. Beam characteristics of a typical vidicon beam are discussed. Also discussed are comparison of storage surfaces, the effect of dark currents, the effect of camera and tube dimensions on resolving power, and computer programs. Author (TAB)

N66-26604# Hughes Aircraft Co., Fullerton, Calif.
RADIATION EFFECTS ON (MONOLITHIC) MICROELECTRONIC CIRCUITS Second Quarterly Report, 1 Aug.–31 Oct. 1965
C. W. Perkins, R. W. Marshall, E. P. Mitchell, and A. M. Liebshutz Fort Monmouth, N. J., Army Electron. Command, Mar. 1966 36 p refs
(Contract DA-28-043-AMC-01313(E))
(FR-65-10-252; ECOM-01313-2; AD-629948) CFSTI: HC $2.00/MF $0.50

Phase 1 (Circuit Evaluation: Evaluation of radiation effects in available circuits) was initiated during the second quarter with the Linac tests for the evaluation of transient radiation effects in thirty-four types of commercially available microcircuits of the DTL, RTL, and RCTL logic types. An evaluation of the results was made by relating the experimentally measured output voltage responses to the circuit noise margins. The results show, in general, the RCTL circuits are the most sensitive to transient radiation effects, that DTL circuits with internal load resistors are less sensitive than those without resistors, and that low power RTL gates are more sensitive than either the standard RTL gate or the RTL power gate. Author (TAB)

N66-26661*# Westinghouse Electric Corp., Los Angeles, Calif.
DEVELOPMENT AND FABRICATION OF A HIGH POWER SILICON SWITCHING TRANSISTOR Final Report, Aug. 1965–Apr. 1966
T. C. New et al [1966] 89 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951303)
(NASA-CR-75133) CFSTI: HC $3.00/MF $0.75 CSCL 09A

High current (I_C = 100 amperes), low saturation ($V_{CE(sat)}$ = 0.2 volt) and low voltage (BV_{CEO} = 20 volts) transistors were fabricated. Two designs were investigated: (1) a modified simultaneously diffused structure; and (2) an epitaxial-diffused structure. The encapsulation was redesigned to allow the saturation requirement to be achieved. The feasibility of the subject transistor has been demonstrated with samples substantiating the objective specifications. Author

N66-26676# Research Triangle Inst., Durham, N. C.
INTEGRATED SILICON DEVICE TECHNOLOGY. VOLUME VIII: DIODES Technical Documentary Report, Jan. 1965–Jan. 1966
R. M. Burger Mar. 1966 156 p refs
(Contract AF 33(615)-3306)
(ASD-TDR-63-316, Vol. VIII; AD-630894) CFSTI: HC $5.00/MF $1.00

Diodes are discussed as elements in silicon integrated devices. The three main sections treat general theory and properties, the specific properties of integrated device diodes, and innovations and results. Emphasis is placed on explaining diode behavior, on particular integrated structures, and on properties peculiar to integrated diodes. It is concluded that diode behavior is not always explained by simple theory and that increased use of a variety of diode properties in integrated devices is possible. Author (TAB)

N66-26760*# Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF THE EFFECT OF SPACE RADIATION ON SILICON INTEGRATED MICROCIRCUITS, VOLUME II Final Report, 26 Jun. 1964–26 Sep. 1965
[1965] 331 p
(Contract NAS5-3985)
(NASA-CR-72216) CFSTI: HC $7.00/MF $1.75 CSCL 09A

Schematic diagrams and information concerning the procedures used in monitoring the behavior of silicon integrated circuits during exposure to an electron radiation environment are presented. Configurations are given for both static and dynamic radiation circuits, and load boxes under various radiation conditions. Data sheets listing the pre- and post-irradiation measurements for specific tests and circuit types are given. Also included are figures showing the variation of an output logic level as a function of electron fluence and monitoring curves for the dynamically operated devices. L.S.

N66-26767# Instituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
A TUNNEL DIODE THRESHOLD DISCRIMINATOR AND PULSE SHAPER [UN DISCRIMINATORE-FORMATORE D'IMPULSI A DIODI TUNNEL]
C. Felici 5 May 1965 20 p refs In ITALIAN; ENGLISH summary
(ISS-65/12) CFSTI: HC $1.00/MF $0.50

A tunnel diode threshold discriminator and pulse shaper circuit has been obtained, suitable for using with high frequency input pulses and, simultaneously, with low threshold values. Threshold of discriminations, continuously variable by means of a helipot between 0.2 V and 2.2 V, and maximum work frequency of 30 Mc/s, input and output impedence 125 Ω are described. Author

N66-26778# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON ELECTROTECHNOLOGY [LITERATUUROVERZICHT ELECTROTECHNIEK]
21 Apr. 1966 33 p refs In DUTCH, FRENCH, GERMAN, and ENGLISH *Its* Vol. 15, No. E-485 CFSTI: HC $2.00/MF $0.50

Abstracts and bibliographic notes are presented on the topics of telecommunications, electronics and microwave techniques, electromagnetic radiation, information processing, software and hardware computers and their applications, measurement and regulation techniques, reduction, interference and reliability, oscillators and magnifiers, components and materials, filters and networks, and energy techniques. Transl. by J.O.

N66-26845*# General Electric Co., Syracuse, N. Y. Semiconductor Products Dept.
RESEARCH TO DETERMINE FAILURE MODES FOR TRANSISTORS
B. Bair ed. [1965] 339 p refs
(Contract NAS8-11059)
(NASA-CR-75304) CFSTI: HC $7.00/MF $1.75 CSCL 09A

This report presents the results of an investigation of the reliability of 1,500 diffused planar transistors of the 2N718A type, manufactured by three separate processes. The transistors were subjected to stress conditions in screens and a matrix life test plan. The stresses included temperature, temperature and bias, power dissipation and centrifuge step stressing of sufficient magnitude to produce failures. The failures were analyzed to assign failure modes and determine whether they were a function of material, process, or design. Charts, graphs and tables were prepared to show population trends, effectiveness of stress screens, burn-in, truncation, and noise screening. The failure analysis procedure, failure mode chart, and the relation of the failure mechanisms and stress conditions were shown. Failure analysis investigations and reports were made to show the relationship of stress, manufacturing process and performance of the devices. Several recommendations are developed for screening techniques to remove failure modes as they are related to the manufacturing process. This report shows that it is possible to develop effective and economical reliability screens related to the manufacturing process used for this diffused planar transistor. Author

N66-26850*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVALUATION OF COMMERCIAL TRAVELING WAVE TUBES FOR APPLICATION IN DIRECT RF TO RF TRANSPONDERS
I. Clay Drillaman 15 Mar. 1965 53 p refs
(NASA-TM-X-55478; X-625-65-46) CFSTI: HC $3.00/MF $0.50 CSCL 09A

A study program was undertaken to investigate the feasibility of developing a wideband, direct RF to RF conversion transponder that utilized mixing techniques in a re-entrant Traveling Wave Tube (TWT) amplifier loop to effect a 6 to 4 Gc frequency shift. Several commercially available TWTs were procured and evaluated so as to determine and thoroughly understand tube performance under wideband multi-signal usage. The tubes were designed for "C" band operation and were of the one or two watt output power variety. General tests embracing gain, noise figure, power output, and VSWR were conducted on four different tubes. Additional tests including carrier suppression, intermodulation effects and impedance were conducted on a representative tube. Analyses and data are presented with respect to as many as three carriers. Discussions include relationships of points of intermodulation product interference with respect to carrier power input, and carrier gain suppression dependency on interfering signal frequency. Author

N66-26851*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRAVELING WAVE TUBE DEVELOPMENT FOR A SERRODYNE RE-ENTRANT AMPLIFIER
Louis J. Ippolito, Walter K. Allen, and Clay Drillaman Apr. 1965 74 p refs
(NASA-TM-X-55479; X-625-65-47) CFSTI: HC $3.00/MF $0.75 CSCL 09A

Program objectives were to study serrodyne techniques and determine TWT characteristics to incorporate in serrodyne re-entrant amplifiers. Investigations included the upper limit of serrodyning, optimum modulation methods and the necessary sawtooth generator circuits. Tube properties studied were amplifier intermodulation, noise figure, and over-all design for optimum re-entrant amplifier characteristics. In practical experiments, three-frequency modulation was applied to the drift tube and to the input and output helix. Three-element modulation was necessary due to waveform distortion and amplitude reduction that arose when trying to modulate the drift tube along with the three frequencies combined. Carrier and second-sideband suppression below the desired sideband were measured at 18 and 20 dB, respectively. Modulation-voltage amplitudes were 34:5:5, close to those determined theoretically. When the re-entrant loop was closed, the desired sideband was translated and underwent 14 dB of gain. Analysis showed that lower conversion loss would be obtained with three- than with two-frequency modulation, the decrease in loss being calculated at 4 dB, and this was verified experimentally. A TWT mixer was fabricated to achieve larger frequency translations, consisting of an input helix centered at 6 Gc, an intermediate helix with local-oscillator input at 10 Gc, and an output helix optimized for operation at the cross-product frequency of 4 Gc. Data are given for different combinations of frequency, to determine bandwidth and output linearity. At the optimum operating point, input-signal gain was 10 dB at the new output frequency. Author

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N66-25387# Polish Academy of Sciences. Warsaw. Inst. of Nuclear Research.
A METHOD FOR DETERMINATION OF THE RESOLVING TIME AND EFFICIENCY OF THE COINCIDENCE CIRCUIT ON THE BASIS OF A SINGLE EMPIRICAL DELAYED COINCIDENCE CURVE [PROSTA METODA OKRESLENIA CZASU ROZDZIELCZEGO I WYDAJNOSCI UKŁADU KOINCYDENCYJNEGO NA PODSTAWIE EKSPERYMENTALNEJ KRZYWEJ OPOZNIONYCH KOINCYDENCJI]
Jozef Kalisz Sep. 1965 48 p refs
(INR-852/IA/PL) CFSTI: HC $2.00/MF $0.50

A mathematical method is described which uses a single empirical delayed coincidence curve to determine the resolving time and efficiency parameters of a coincidence circuit. The method can be used if the time delay distributions of the coincidence circuit are noncorrelated Gaussian jitter distributions, and as long as effects of rate and amplitude overloading are neglected. Simultaneous calculation of resolving time, jitter breadth, and coincidence efficiency is accomplished; and results can be checked by making measurements at different points of the curve. M.W.R.

N66-25531*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
THE DISCRETE MINIMUM PRINCIPLE WITH APPLICATION TO THE LINEAR REGULATOR PROBLEM
David L. Kleinman and Michael Athans Feb. 1966 30 p refs
(Grant NsG-496; Proj. DSR-9952)
(NASA-CR-74852; ESL-R-260) CFSTI: HC $2.00/MF $0.50 CSCL 09C

The purpose of this report is to summarize in the form of a discrete minimum principle the necessary conditions for optimality which have been derived for the optimal control of a class of discrete-time systems. The discrete minimum principle is used to derive the optimal feedback control law when the discrete dynamical system is linear and the index of performance is quadratic. Author (TAB)

N66-25562*# Stanford Univ., Calif.
THE OPTIMIZATION OF A RELAY CONTROLLED SYSTEM SUBJECTED TO RANDOM DISTURBANCES
Gregory August Hyver Washington, NASA, May 1966 98 p refs
(Grant NsG-133-61)
(NASA-CR-491) CFSTI: HC $3.00/MF $0.75 CSCL 09C

An optimal solution is advanced in which certain statistical properties of the optimal control are determined. It is assumed that the plant is disturbed by Gaussian noise of known spectral density. The stochastic control problem is reformulated so that the maximum principle can be used. The design problem was to zero a given state in a prescribed time while requiring a certain performance criterion be minimized during the process. The dynamical system is assumed to be linear with additive noise at the input. The control signal and the performance signal are described. The minimum fuel expenditure, the minimum final state variance, and the applications to physical systems are discussed. It is shown that the relay control system can be realized as a very simple feedback control system. It is suggested that this method may result in additional information about the properties of the optimal solution, and that this additional information can be used in the realization of quasi-optimal schemes. N.E.N.

N66-25566# Joint Publications Research Service, Washington, D. C.
LAPLACE–GALOIS TRANSFORM IN THE THEORY OF SERIES MACHINES
Ya. Z. Tsypkin and R. G. Faradzhev 3 May 1966 12 p refs
Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 166, no. 3, 1966 p 570–573
(JPRS-35310; TT-66-31746) CFSTI: $1.00

Lattice Boolean functions, which take their values from the finite Galois field, and their discrete Laplace transformations were investigated. This investigation, it is hoped, will enable the establishment of a theory of series machines similar to the theory of pulse systems. D.T.

N66-25614# Illinois Univ., Urbana. Coordinated Science Lab.
AN IMPROVEMENT IN THE STATE AXIOMS

James Resh Mar. 1966 25 p refs
(Contract DA-28-043-AMC-00073(E))
(R-282; AD-630030) CFSTI: HC $2.60/MF $0.50

This report considers Zadeh's axiomatic formulation of the notion of state descriptions. It shows that, in addition to admitting system descriptions which would pass as state descriptions in the ordinary senses of the word, that definition also admits an extremely degenerate state description for any system. After discussing a number of the axioms' flaws, which are manifested by this degenerate description, a modification in the definition is proposed and defended.
Author (TAB)

N66-25759# Joint Publications Research Service, Washington, D. C.
CYBERNETICS AND CONTROL THEORY, ASYMPTOTICALLY OPTIMAL SYSTEMS—LEARNING OPTIMAL CONTROL
Yu. P. Leonov 16 May 1966 10 p refs Transl. into ENGLISH from Dokl. Akad Nauk SSSR (Moscow), v. 167, no. 3, 1966 p 538–539
(JPRS-35531; TT-66-31967) CFSTI: $1.00

Consideration is given to a control system which is asymptotically optimal with respect to some quality criterion. A recursion expression is used to find the series which determines the control signal for an object with random disturbances whose statistical characteristics are unknown. The method used may be interpreted as teaching the system optimal control, and the training process is formalized with the aid of a homogeneous Markov chain. M.W.R.

N66-25875# Texas Univ., Austin. Labs. for Electronics and Related Science Research.
TEXAS BIANNUAL OF ELECTRONICS RESEARCH NO. 2; A SUMMARY OF RESEARCH FOR THE PERIOD APRIL 1, 1965 THROUGH SEPTEMBER 30, 1965
Arwin A. Dougal 15 Nov. 1965 182 p refs
(Grant AF-AFOSR-766-65)
(AD-479817)

Summaries are presented of research projects dealing with biomedical electronics; information sciences; physical, quantum, and plasma electronics; and space, atmospheric, and Earth radio sciences. Visual response to laser stimulation is discussed, as is chromosome classification by band structure and a model of a biological clock. A condition for absolute stability for an *nth* order nonlinear system is established, an inner bound for periodic and aperiodic oscillations is derived, and a realization algorithm is reported which assures maximum stability of linearly separable switching functions. Other information science reports consider flip-flop memory elements, simulation theory, filters, coding, adaptive systems, and systems control. The first observation of broadband microwave emission from n-type indium arsenide is reported in the presence of applied electric and magnetic fields at liquid nitrogen temperature. Other researches are concerned with plasmas, semiconductors, wave propagation, and planetary atmospheres and surfaces. M.W.R.

N66-25951# Michigan Univ., Ann Arbor. Electron Physics Lab.
SEMICONDUCTOR AND O-TYPE AMPLIFIER INVESTIGATIONS Quarterly Progress Report No. 5, 1 Sep.–1 Dec. 1965
J. E. Rowe et al Griffiss AFB, N. Y., RADC, Mar. 1966 43 p refs
(Contract AF 30(602)-3569)
(RADC-TR-66-20; AD-630474) CFSTI: HC $4.60/MF $0.50

Specific results on saturation gain and efficiency for Brillouin beam traveling-wave amplifiers are presented as a function of beam injection velocity and magnetic field strength. It is found that the saturation gain and output are higher for the Brillouin-focused device than for the rectilinear-flow device. A perturbational analysis of the small-C nonlinear TWA equations was undertaken. Testing of the microperv gun was terminated due to the failure of its heater. The design of a device for determining the effect of large-amplitude r-f signals on an electron beam was completed. Errors in the space-charge calculations for high-convergence electron guns were corrected and as a result greater accuracy and agreement with experiments were obtained. Although improvements were made in the magnetron injection gun program, it is still difficult to obtain proper convergence in the vicinity of the cathode. A UHF helix-type traveling-wave amplifier with a magnetron injection gun was studied experimentally with regard to the noise characteristics of the gun and the beam in the interaction region. Reasonably low noise figures were obtained at reduced beam current and it is expected that lower noise figures will be realized when the amplifier is operated at rated current. Author (TAB)

N66-26079# Joint Publications Research Service, Washington, D. C.
ELECTRONICS AS KEY TO PROGRESS
A. I. Berg 18 May 1966 11 p Transl. into ENGLISH from Krasnaya Zvezda (Moscow), 7 May 1966 p 2
(JPRS-35586; TT-66-32021) CFSTI: $1.00

This paper discusses the rapid advancement of electronics and its applications to the field of radio communications; to methods and devices for collecting, storing, and processing information; to energy conversion; and cybernetics. R.N.A.

N66-26088# Joint Publications Research Service, Washington, D. C.
ANALYSIS OF THE QUASI-STEADY-STATE OSCILLATIONS IN A PULSE GENERATOR SUPPLIED FROM A FREQUENCY MULTIPLIER
A. P. Makarov *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 4–7 refs (See N66-26086 14-14) CFSTI: $6.00

A method of increasing the pulse repetition rate in magnetic pulse generators is examined. It consists of converting the frequency of the source to the generator by using static electromagnetic frequency multipliers. It is stated that the chief advantage of this method is the high reliability of the multiplier–generator system. The fundamental uncompensated harmonic which is present in the multiplier output is mathematically accounted for by introducing the source of the voltage as a parameter. Differential equations are solved which define the processes involved in the circuitry. H.S.W.

N66-26090# Joint Publications Research Service, Washington, D. C.
SENSITIVITY OF THE ALTERNATING-CURRENT BRIDGE CIRCUITS
T. A. Zhuravleva *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 18–24 refs (See N66-26086 14-14) CFSTI: $6.00

Previous investigations have shown that it is possible to evaluate the properties of balanced and quasi-balanced alternating current bridge circuits by analyzing a generalized bridge circuit equation. This method is used to evaluate the sensitivity of bridge circuits in the vector, modular, and phase modes

of measurement. Equations are derived for each of the modes considered, and it is shown that the sensitivity of a bridge circuit can be evaluated if the function W (the output quantity of a bridge circuit) is known. The derived expressions are shown in a table, and the coefficients of W may be substituted into the appropriate expressions to obtain the sensitivity parameters of the circuit considered. H.S.W.

N66-26093# Joint Publications Research Service, Washington, D. C.

A STOCHASTIC APPROACH TO THE ANALYSIS OF THE DYNAMICS OF AUTOMATIC SYSTEMS

G. S. Chernorutskiy *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 40–45 refs (See N66-26086 14-14) CFSTI: $6.00

The article sets forth a general approach to the analysis of the dynamics of automatic systems in calculating the variations of two random parameters. Appropriate formulas have been derived to determine the probability of the stability of standard servosystems. Author

N66-26094# Joint Publications Research Service, Washington, D. C.

AN INVESTIGATION OF THE STABILITY OF SECOND-ORDER RELAY SYSTEMS IN THE PRESENCE OF NONLINEAR FEEDBACKS

V. M. Ageyev *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 46–50 refs (See N66-26086 14-14) CFSTI: $6.00

It is shown that if the relay function of a class of single-stage and two-stage nonlinear servomechanisms is a linear function of the phase coordinates, the method of degenerate cycles may be used in investigating these relay systems. This method is applied to a case where nonlinear feedbacks exist in the system. Differential equations which describe the system considered are given, and mathematical expressions are offered which support the conclusion that a unique limit cycle exists in the system. H.S.W.

N66-26116# Joint Publications Research Service, Washington, D. C.

PREDICTING A CHANGE IN THE CONDITION OF AN AUTOMATIC SYSTEM

D. V. Gaskarov and A. V. Mozgalevskiy *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 182–187 refs (See N66-26086 14-14) CFSTI: $6.00

The article sets forth a problem on the feasibility of supervising a system by means of utilizing the random values of the parameters being monitored. The prediction of a change in the condition of a system may be made by applying the basic principles of the correlation analysis. Author

N66-26286*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

DERIVATION OF THE MATHEMATICAL TRANSFER FUNCTION OF AN ELECTRODYNAMIC VIBRATION EXCITER

C. P. Chapman 15 May 1966 19 p refs
(NAS7-100)
(NASA-CR-75151; JPL-TR-32-934) CFSTI: HC $1.00/MF $0.50 CSCL 09C

The transfer function of an electrodynamic vibration system (power amplifier and vibration exciter) is defined as the ratio of table accelerations to input voltage. The equation is itself a function of frequency. An input signal with a given frequency is applied to the input of the system; the signal appears at the output, multiplied by the magnitude of the transfer function, with its phase shifted by the phase angle of the transfer function. This report presents a detailed solution of the mathematical equation that describes a typical electrodynamic vibration system. The mathematical analysis is compared with the empirical transfer function of a particular vibration exciter to demonstrate the validity of the equation and the value of mathematics and computers for analysis of vibration techniques. Author

N66-26364# Army Electronics Labs., Fort Monmouth, N. J.

HOLLOW BEAM FORMATION IN HIGHLY CONFINED ELECTRON FLOW

Bruno Zotter Mar. 1966 18 p refs
(ECOM-2673; AD-631163) CFSTI: HC $1.60/MF $0.50

The formation of electron beams in low-noise guns for traveling-wave tubes (TWT's) is investigated. The experimentally observed hollowing-out is explained by a simple model which assumes constant voltage along the beam. The derived relationships are then independent of the particular electric fields which cause the beam spreading. In fact, they only relate initial conditions to quantities further downstream where the beam is again in equilibrium flow. By neglecting an extended accelerating region, the calculation of the radial space charge forces may be accomplished. However, this limits the solutions to cases of negligible emission density at the axis, which is otherwise arbitrary across the cathode. Due to the space-charge cloud in the center of the beam and to the strong radial fields at the edge of the cathode, this condition is usually fulfilled in actual TWT guns. In fact, a number of tubes use hollow cathodes which have no emission at the axis. Author (TAB)

N66-26368# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.

STUDY OF TRANSVERSE WAVE INTERACTIONS Quarterly Report No. 1

R. L. Schriever, M. T. Ahlquist, C. H. Durney, C. C. Johnson, and R. W. Grow Oct. 1965 47 p refs *Its* Rept.-1
(Contract DA-28-043-AMC-01279(E))
(ECOM-01279-1; AD-629904) CFSTI: HC $4.60/MF $0.50

Experiments with a rotating electron beam waveguide device have been performed. The device used in this investigation has been found to exhibit a strong transverse wave interaction. The interaction takes place at a frequency which is close to the cyclotron frequency of the electron beam. Frequency measurements indicate that the interaction frequency is slightly less than the cyclotron frequency and that the interaction frequency varies inversely with beam voltage. Both gain and oscillation have been observed. The interaction appears to be of a backward-wave nature. The transverse-wave interaction theory indicates that backward-wave but not forward-wave active coupling may occur. The observed values of gain are less than the calculated values but are within an order of magnitude. The interaction is found to be strong at the cutoff frequencies. This is in agreement with the transverse-wave theory. The interaction appears to be greatly influenced by the reflections in the waveguide circuit. The results of this investigation indicate that strong transverse interactions can occur in fast-wave circuits. Succeeding experimental work will require a circuit which has better transmission over a broad frequency range. This could be easily accomplished with a broadband vacuum window. An improved beam launching system is still needed if beam parameter effects are to be more carefully observed. Author (TAB)

N66-26382# Ohio State Univ. Research Foundation, Columbus.

THE EFFECT OF A PURE TIME DELAY ON THE STABILITY OF A PHASE-LOCK LOOP Interim Report

R. T. Compton, Jr. Griffiss AFB, N. Y., RADC, Feb. 1966 52 p refs *Its* Rept.-1963-6

(Contract AF 30(602)-3601)

(RADC-TR-65-232, Vol. II; AD-630473) CFSTI: HC $3.00/MF $0.50

The report discusses the effect of 'transport lag' or pure time delay in the feedback loop of a phaselock control system. The system analyzed is that which controls the relative phases of several transmitters to provide a coherent signal at a satellite. The report first derives the equation of the control loop, linearizes the resulting differential-difference equation, considers the loop to have unit compensation, and proceeds to discuss the solution. The results of this analysis are that, for stable operation, the loop gain may not exceed $\pi/2T$ for a time delay of T seconds, which results in a steady-state phase error of $2\omega_0 T/\pi$. Author (TAB)

N66-26458# Stanford Univ., Calif. Stanford Linear Accelerator Center.

ITERATIVE CHEBYSHEV APPROXIMATION TECHNIQUE FOR EQUALIZER SYNTHESIS

G. C. Temes and J. A. C. Bingham Oct. 1965 14 p refs Presented at the Allerton Conf. on Circuit and System Theory, Urbana, Ill., 20–22 Oct. 1965

(Contract AT(04-3)-400)

(SLAC-PUB-146; CONF-651058-1) CFSTI: HC $1.00/MF $0.50

The Remez–Werner algorithm is extended to the Chebyshev approximation of general loss and phase characteristics. The resulting technique is useful for the design of equalizers, pulse-shaping networks, impedances, and delay lines. The application of the process to the synthesis of a video cable system is described. Author (NSA)

N66-26523# Ballistic Research Labs., Aberdeen Proving Ground, Md.

ON THE INFLUENCES OF CHANGES OF CARRIER DENSITY ON THE CURRENT FLOW IN A CHANNEL

Keats A. Pullen, Jr. and Lee Evans (Siliconix, Inc.) Sep. 1965 28 p refs Prepared in cooperation with Siliconix, Inc. Partially supported by DASA

(BRL-1301; AD-630064) CFSTI: HC $2.60/MF $0.50

A study was made of the effect of varying the density of free charge carriers in a semiconductor channel under the influence of a retarding field. It was found that the conditions required for charge binding in the space-charge region are dramatically altered by changes in the distribution of charge. The transconductance per unit current is also drastically altered. Based on the study, it can be presumed that significantly more efficient field effect transistors can be built than have been obtained to date. Author (TAB)

N66-26554*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Texas.

A COMPARATIVE ANALYSIS OF CASCADE AND FEEDBACK COMPENSATION

Donald K. Norling (M.S. Thesis—Houston Univ.) May 1966 131 p refs

(NASA-TM-X-58000) CFSTI: HC $4.00/MF $1.00 CSCL 09C

This thesis presents a comprehensive analysis and comparison of the relative effects of cascade and feedback compensation upon the steady-state and dynamic performance of feedback control systems. In particular, system sensitivity, steady-state system error and actuating signal, log-modulus response, and pole-zero considerations are investigated for cascade compensation and various forms of feedback compensation. Equations relating equivalent feedback and cascade compensators for a given uncompensated plant and an overall system transfer function are developed. Conditions are specified for the realizability of feedback compensators as R-C networks. Specific advantages and limitations of the various modes of compensation are noted and general insight is provided into the relative suitability of cascade and feedback compensation for a given system and set of performance specifications. Author

N66-26594# General Dynamics/Electronics, Rochester, N. Y.

ADAPTIVE PROGRAMMING TECHNIQUES FOR CIRCUIT DESIGN Final Report, 21 Aug. 1964–21 Aug. 1965

Donald F. Smith, Amante S. Parungao, and Carl J. Zarcone Griffiss AFB, N. Y., RADC, Feb. 1966 156 p refs

(Contract AF 30(602)-2961)

(RADC-TR-65-394; AD-629786) CFSTI: HC $4.00/MF $1.00

This report covers the evaluation of various pattern recognition techniques previously developed and reported in 'Adaptive Programming Techniques for Circuit Design,' (AD-602 110). New techniques developed under the current contract are also evaluated. The evaluation of the relative merits of each technique is based on how well it succeeds in minimizing the classification error rate in the recognition of the population while learning on the sample pattern set. A sample pattern recognition problem, consisting of two population distributions and a sample pattern set obtained from these population distributions, is generated. This sample problem is used in assessing the relative merits of the various techniques. Author (TAB)

N66-26664*# Massachusetts Inst. of Technology, Cambridge. Research Lab. of Electronics.

RESEARCH LABORATORY OF ELECTRONICS QUARTERLY PROGRESS REPORT NO. 80

H. J. Zimmermann and G. G. Harvey 15 Jan. 1966 314 p refs

(Contract NSR-22-009-120; Grants NsG-496; NGR-22-009-091; NGR-22-009-131; NsG-334 et al)

(NASA-CR-75149) CFSTI: HC $7.00/MF $1.75 CSCL 09

Continuing research is reported on: ultrasonics and acoustics, geophysics and gravitation, and spectroscopy; plasma dynamics and energy conversion; and communication theory, information processing, biophysics and neurophysiology, computation research, and related topics. N.E.N.

N66-26833# Air Force Cambridge Research Labs., Bedford, Mass. Microwave Physics Lab.

AN IMPROVED FEEDBACK RADIOMETER

William B. Goggins, Jr. Feb. 1966 34 p refs *Its* Instrumentation Papers No. 94

(AFCRL-66-122; AD-630613) CFSTI: HC $2.00/MF $0.50

Feedback applied to a radiometer will stabilize its gain. Two improved versions of an earlier feedback radiometer system have been built and tested. One used a mechanical attenuator, and the other an electronic attenuator. The following improvements were incorporated: faster responding and more accurate servo-driven noise source, a current-source driver for the ferrite switch, more versatile rf circuitry, improved coherent detector, and transistorized circuitry. The response of

both servo loops proved to be fast enough and linear enough, for almost any radiometer application. Author (TAB)

N66-26879*# New York Univ., N. Y. Lab. for Electroscience Research.
THE AVERAGE NUMBER OF ZERO CROSSINGS PER SECOND OF A SINUSOIDAL SIGNAL PLUS NOISE Technical Memorandum No. 44
Gerald Weiss Jan. 1965 51 p refs
(Contract NAS5-9809)
(NASA-CR-75279) CFSTI: HC $3.00/MF $0.50 CSCL 09C

The measurement of the average frequency of a sinusoidal voltage source may be implemented by counting the average number of zero crossings which have accrued in a given counting period. This report considers two models which show the effect of noise on the average number of zero crossings per second. One model utilizes as a signal source a quasi-harmonic sinusoidal voltage which is characteristic of a propagated signal subject to fading. The other model assumes a fixed sinusoidal voltage which may be the output of a signal generator. In both of these models, the signal source voltage is added to a random voltage which is Gaussian distributed, and the number of zero crossings is averaged over an infinite period of time. These results, then, establish an upper limit on the error in measuring frequency by a zero count technique. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N66-25390# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Reaktorzentrum.
APPLICATION OF RADIOACTIVE TRACER TECHNOLOGY IN HIGH VACUUM IN THE CONSTRUCTION OF A MASS SEPARATOR-COLLECTOR FOR XENON [ANWENDUNG DER RADIOAKTIVEN TRACERTECHNIK IN HOCHVAKUUM ZUR KONSTRUKTION EINES MASSENSEPARATORKOLLEKTORS FUR XENON]
R. Dobrozemsky, E. Hechtl (Inst. für Experimentalphysik), and F. P. Viehbock 1965 26 p refs In GERMAN Submitted for Publication
(SGAE-PH-31/1965) CFSTI: HC $2.00/MF $0.50

Principle and operation of an electromagnetic mass separator-collector for the separation of xenon isotope of maximum purity are given, with emphasis on the operation of the collector. Collection is through adsorption in activated charcoal. Isothermic measurements by the radioactive tracer method became necessary when a loss of xenon due to pressure conditions in the collector chamber was noted. The use of Xe-133 isotope in high vacuum for this purpose is described in detail. Transl. by K.W.

N66-25406# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
PISTOL SHOOTING RANGE WITH NOISE LEVEL CONTROLS AT LAREN [LAWAAIHINDER PISTOOLSCHIETBAAN TE LAREN]
R. Plomp Jan. 1966 18 p In DUTCH
(IZF-1966-2; TDCK-44729) CFSTI: HC $1.00/MF $0.50

In order to reduce the noise level on a double shooting range for pistols, the walls and the roof are provided with a sound absorbing layer, by which a considerable improvement was achieved. The use of good ear defenders is still required. Author

N66-25460# National Aeronautical Lab., Bangalore (India).
[FACILITY DESCRIPTION AND SURVEY OF CURRENT RESEARCH AT THE NATIONAL AERONAUTICAL LABORATORY] Annual Report, 1964-1965
[1965] 92 p refs
CFSTI: HC $3.00/MF $0.75

This report describes the facilities constructed and the activities performed during the past year at the National Aeronautical Laboratory, Bangalore, India. Included are descriptions of the laboratory's organization, the trisonic wind tunnels and associated research, the induction tunnel, low speed wind tunnel, vortex tunnel, rheoelectrical analogy techniques, diffuser research, jet noise studies, aerospace studies, research on structures and materials, studies on wind powered electric generators, and research information, liaison, extension, and associated activities. R.N.A.

N66-25489# Universidad Autonoma de San Luis Potosi (Mexico). Escuela de Ingenieria.
CONSIDERATIONS FOR THE INTEGRATION OF A TEST CENTER AND ROCKET LAUNCHER IN MEXICO [CONSIDERACIONES PARA LA INTEGRACION DE UN SITIO DE PRUEBA Y LANZAMIENTO DE COHETES EN LA REPUBLICA MEXICANA]
Francisco J. Gonzáles Hernández (Ph.D. Thesis) 1966 145 p refs In SPANISH
CFSTI: HC $4.00/MF $1.00

The geophysical, atmospheric, and economic factors involved in establishing a rocket launching test facility are discussed. Ground support equipment and communication systems were studied along general lines, with a view to improving scientific and technical education in these areas. The technology needed to develop new products, processes, and techniques is considered, along with the necessity of limiting operational costs. The impact of subsequent industrial applications is also assessed. Atmospheric studies were conducted, and graphs are included on atmospheric composition, temperature, and vertical distribution of the atmospheric density. The range between 30 and 200 kms was selected as feasible for test firing purposes, with technical and rocket designs suitable for this zone to be used. Various methods of controlling rocket flights are diagrammed; firing trajectories, geophysical features of the site, and liquid, solid, and hypergolic propellants are considered. Security and safety features of the test facility are designated as of prime importance. Transl. by R.Li.

N66-25492# European Organization for Nuclear Research, Geneva (Switzerland). Accelerator Research Div.
STABILIZATION OF A VAN DE GRAAFF GENERATOR
C. Carter, S. Hansen, E. Jones, and R. W. A. Nettleton 7 Mar. 1966 39 p
(CERN-66-11)

This report describes a fast stabilization system that was incorporated into the 2 MeV electron double beam Van de Graaff used as an injector for the CERN electron storage and accumulation ring. The Van de Graaff has two acceleration tubes. The pulsed electron beam of one is injected into the storage ring. The beam from the second tube is used both to monitor and stabilize the terminal voltage. Thus, this second

beam is used to relate the Van de Graaff voltage to the mean bending field of the storage ring thereby providing a practical stabilizing system. The system reduces voltage fluctuations to less than one part in ten thousand of the nominal top-terminal voltage. The recovery time of the Van de Graaff is also considerably reduced. R.N.A.

N66-25527*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
TECHNIQUES FOR THE REMOTE MONITORING OF HYPERGOLIC PROPELLANT LEAKS
Peter M. Ricca 25 Feb. 1966 30 p
(NASA-TM-X-57519; GP-220) CFSTI: HC $2.00/MF $0.50 CSCL 22D

Techniques for detecting malfunctions in ground support equipment are reviewed with special emphasis on the toxicity hazards provided by hypergolic propellant leakage. Requirements for monitoring toxic gases are discussed, as are means of data collection. The toxic leak detection subsystem proposed for the Saturn V mobile service structure is discussed as a typical detection sensor system, with consideration given to data transmission and display. M.W.R.

N66-25540*# Geophysics Corp. of America, Bedford, Mass.
SPUTTERING ION SOURCE STUDY PROGRAM, PHASE I Final Report, 31 Jul. 1961–28 Jan. 1962
28 Jan. 1962 105 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950118)
(NASA-CR-74943) CFSTI: HC $4.00/MF $0.75 CSCL 20G

A preliminary design is presented of an ion source for quantitative analysis of solids which uses the principle of sputtering secondary ions from a sample surface which is bombarded by highly energetic primary ions. The primary ions, produced in a douplasmatron which delivers a homogeneous beam of positive ions at an intensity of several milliamperes, can be accelerated to energies up to 30 kilovolts. Secondary ions are accelerated and focused on the mass spectrometer slit. Detailed drawings of the apparatus are included. M.W.R.

N66-25541*# Geophysics Corp. of America, Bedford, Mass.
SPUTTERING ION SOURCE, THIRD PHASE Final Report, 29 Mar.–30 Sep. 1963
Helmut J. Liebl [1963] 33 p Prepared for JPL
(Contracts NAS7-100; JPL-950576)
(NASA-CR-74944; GCA-TR-63-7-G) CFSTI: HC $2.00/MF $0.50 CSCL 20G

Improvement and modifications in the power supply, duoplasmatron, and optics of a sputtering ion source permit its operation at bombarding ion energies up to 25 kV and reduce the bombarded spot on the sample to about one-half millimeter. Extensive runs indicate the sputtering ion source to exhibit performance superior to that of a standard spark source. Complete secondary ion spectra up to mass number 350 were sputtered from 13 different pure elements which were bombarded with 10 kV argon ions; and the spectrum is shown for a pure ion sample. For the other elements, there is a listing of the ions deduced from the major peaks. Preliminary runs are also reported for zirconium ions sputtered from several zirconium compounds. M.W.R.

N66-25587# India. Dept. of Atomic Energy, Bombay.
AEROSOL GENERATOR TO PRODUCE RADIOACTIVE AEROSOLS
P. Kotrappa, G. S. Jauhri, and S. K. Dua 1965 19 p refs
(AEET-232) CFSTI: HC $1.00/MF $0.50

An aerosol generator (modified version of Lauterbach type) has been built to produce heterogeneous aerosols of about 0.2 micron MMD of activated sodium chloride (Na-24) and activated sodium dihydrogen phosphate (P-32). The unit is compact and being on wheels makes it versatile. It has been tested for steady output over extended periods of operation. It was also found that mass median diameter of aerosols created did not vary much with concentration of NaCl in the range of 1% to 10%. However, the output increased five fold when concentration is increased from 1% to 10%. Size analyses of the aerosol are made using electron microscope. The use of this generator in filter evaluation studies, calibrating air monitors and such other applied Health Physics work has been demonstrated. Author

N66-25602# Aerodynamische Versuchsanstalt, Gottingen (West Germany).
INVESTIGATION OF A MODEL TUBE WINDTUNNEL [UNTERSUCHUNGEN AM MODELL-ROHRWINDKANAL]
Th. Hottner 14 Feb. 1964 69 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft
(Rept.-64-A-04) CFSTI: HC $3.00/MF $0.75

The model was constructed to examine boundary layer effects in the pressure chamber of the tube in order to test feasibility of short-period air force measurings during aerodynamical investigations. The tunnel chamber is 55 m long, has a 200-mm inner diameter, can be electrically heated to 400°C, and leads into four supersonic nozzles for Mach 3 to 8. Mach values obtained in tests varied in correspondence with convergence ratio of nozzles. Air pressure measurings were also performed with satisfactory results. K.W.

N66-25634# National Aeronautical Lab., Bangalore (India).
OPTIMISATION STUDIES FOR A THREE DIMENSIONAL TRANSONIC TEST SECTION FOR THE 5 IN.X5 IN. INDUCTION TUNNEL
P. Jagannadha Rao, N. L. Arora, and Y. V. G. Acharya Nov. 1965 39 p refs
(TN-AE-29-65) CFSTI: HC $2.00/MF $0.50

The performance of the 5 in.X5 in. induction tunnel with a three-dimensional transonic test section has been studied. The results are presented as Mach number distribution along the perforated wall. The flow in the test section was partly expanded in the test section itself by suitably shaped corner inserts. The equivalent plenum Mach number and Mach number distribution were found out with a large number of variations in plenum vent, corner expansion, and wall divergence to find out the optimum configuration to obtain maximum tunnel efficiency and test-section flow quality. It was found out that corner expansion in some cases improves nozzle efficiency and test-section flow quality. For an injector blowing pressure of 50 p.s.i.g. and with wall divergence of 1/2° and a vent open area of 0.085 A_T, test-section Mach number of 1.2 can be attained which is reasonably constant over a region of 1.7 times the test section heights. Author

N66-25639# Kernforschungsanlage, Juelich (West Germany).
NUCLEAR RESEARCH FACILITY JUELICH REPORT FOR THE YEAR 1964 [KERNFORSCHUNGSANLAGE JUELICH BERICHT FUER DAS JAHR 1964]
[1965] 195 p refs In German
CFSTI: HC $5.00/MF $1.25

Detailed reports of activities in a nuclear research facility are presented in the fields of (1) botany, (2) microbiology, (3) zoology, (4) agriculture, (5) medicine, (6) radiochemistry, (7) chemical engineering, (8) high energy physics, (9) nuclear

physics, (10) construction and development of a thorium reactor, (11) reactor materials, and (12) plasma physics. The operation and maintenance of facilities, installations, and equipment are described; and the general administrative operations and finances of the facility project are discussed. L.S.

N66-25644# India. Dept. of Atomic Energy, Bombay.
METALLIC HALIDE ELECTRODELESS DISCHARGE LAMPS
P. Ramakoteswara Rao, P. C. Ghosh, T. K. Balasubramanian, and G. L. Bhale 1965 30 p refs
(AEET-236) CFSTI: HC $2.00/MF $0.50

A method is described for the preparation of electrodeless discharge lamps, of ThI_4, UI_4, and $FeCl_3$, which emit sharp and intense line spectra of thorium, uranium, and iron, respectively, upon excitation with a 2450 Mc/sec microwave oscillator. It is pointed out that different lamps prepared in an apparently identical way exhibit different lifetimes and excitation characteristics. Differences in service lives of thorium iodide lamps and their resultant spectra are cited as examples, and it is suggested that these variations are due to amounts of ThI_4 deposited inside the discharge tube. Selective excitation and self-absorption of the spectra are discussed; and the possible use of such lamps in spectrochemical analysis is mentioned. M.W.R.

N66-25645# European Organization for Nuclear Research, Geneva (Switzerland). Accelerator Research Div.
SERVO CORRECTION OF PHASE CHANGES BETWEEN DEFLECTORS IN THE R.F. SEPARATOR
P. Bramham 17 Feb. 1966 48 p refs
(CERN-66-8)

Operation of a radio-frequency particle separator requires a stability of r.f. phase between deflecting cavities to two or three degrees. Most of the phase changes which occur are sufficiently slow to be corrected by a servo system involving a motor-driven wave-guide phase shifter. Information to turn the motor is supplied by a phase comparison bridge connected to the cavities. The various component units of the system are described, and an analysis is made of its performance. Author

N66-25816# Kitt Peak National Observatory, Tucson, Ariz.
[ACTIVITIES OF KITT PEAK NATIONAL OBSERVATORY, TUCSON, ARIZONA AND CERRO TOLOLO INTER-AMERICAN OBSERVATORY, LA SERENA, CHILE] Monthly Report, Jul.–Aug. 1965
J. Stock [1965] 32 p Sponsored by NSF Prepared in cooperation with Cerro Tololo Inter-Am. Obs.
CFSTI: HC $2.00/MF $0.50

Construction activities were reported interrupted at the Cerro Tololo Inter-American Observatory due to very severe weather. A narrative account is given of the eclipse expedition to Bellingshausen and Manuae. Unfortunately, a cloud bank covered the sun one-half hour before totality and passed on one hour after totality. The June 23, 1965, Aerobee flight, is discussed. The cross spin stabilization system is described, and is considered to work better than expected. The radar transponder failed, but the telemetry was reported strong, and the pointing control functioned satisfactorily. The difficulties connected with the low apogee are indicated. The solar X-ray instrument package is described, with emphasis on the camera design and orientation. Five discreet X-ray sources were detected. Comparison of the X-ray images with calcium and microwave spectroheliograms showed close correlation. An X-ray sensitive strip camera is described. X-ray intensity measurements and electron flux detection are mentioned. N.E.N.

N66-25853# David Taylor Model Basin, Washington, D. C.
THE HYDROGEN-BUBBLE, FLOW-VISUALIZATION TECHNIQUE Final Report
George E. Mattingly Feb. 1966 51 p refs
(DTMB-2146; AD-630468) CFSTI: HC $3.00/MF $0.50

The hydrogen-bubble visualization technique was adapted to a 12-inch variable-pressure water tunnel. An outline of this adaption and the operation of the technique are described. Photographic techniques and analyses applied to the resulting films are discussed. Sources of error are delineated, particularly with regard to the deceptive streakline patterns that can be formed and especially the results of exceeding the velocity limitation imposed by the shedding phenomena taking place behind the platinum wires. Errors caused by compression and/or stretching of bubble lines along their length are discussed, and procedures are given for recognizing this type of error. In addition, cathode-wire configurations are described by which both longitudinal and transverse velocity profiles can be obtained in steady or unsteady water flows. Various cathode-wire configurations are described through which qualitative aspects of the flow about bodies as stagnation and separation point motions are depicted. Author (TAB)

N66-26016# Kernforschungszentrum, Karlsruhe (West Germany).
LABORATORIES FOR WORK WITH RADIOACTIVE MATERIALS. BIBLIOGRAPHY ON PLANNING, BUILDING, ARRANGEMENT AND EQUIPMENT, PART III [LABORATORIEN FUER ARBEITEN MIT RADIOAKTIVEN STOFFEN. BIBLIOGRAPHIE UBER PLANUNG, BAU, EINRICHTUNG U. AUSRUESTUNG, TEIL III]
G. Brossmann Oct. 1965 120 p refs In GERMAN
(KFK-370)

References (425) are given to journals and reports published from 1955 through 1964. NSA

N66-26031# Iowa State Univ. of Science and Technology, Ames.
THE DESIGN AND PERFORMANCE OF A LONG-PATH OXY-ACETYLENE BURNER FOR ATOMIC ABSORPTION SPECTROSCOPY
John Angelo Fiorino (M. S. Thesis) Nov. 1965 63 p refs
(Contract W-7405-ENG-82)
(IS-T-69) CFSTI: HC $3.00/MF $0.75

The design and performance of a long-path premixed oxyacetylene slot burner for atomic absorption spectroscopy were studied. Design of the burner is described in detail. Many hours of successful burner operation provided ample proof that the burner is safe to use. The detection limits for a number of metallic elements were in most instances significantly reduced and equally important, and analytical sensitivities were greatly improved. The success of the burner was dramatically demonstrated by the observation of lanthanum and tungsten in absorption, neither of which could be observed at the 1% concentration level with the three-burner triple-pass system. The improvement of the detection limits and sensitivities combined with the low audible noise demonstrate the superior performance of the slot burner. The burner provides a good environment for the existence of free atoms and is thus a useful tool in atomic absorption spectroscopy. Author (NSA)

N66-26075# California Univ., Los Angeles. Dept. of Engineering.
PERFORMANCE STUDIES ON NOTS-UCLA TRACKING SIMULATION: INDEPENDENT EFFECTS OF ERROR MAGNIFICATION, FIELD OF VIEW AND TRAJECTORY DYNAMICS Technical Report No. 34

Russell L. Smith, David R. Garfinkle, Hilde Groth, and John Lyman Apr. 1966 52 p refs
(Contract N123(60530)23558A)
(Rept.-66-23)

An experiment was conducted on the NOTS-UCLA Tracking Simulator to determine the independent effects of error magnification and field of view on tracking performance. Magnification was achieved by either increasing the display gain or decreasing the subject-to-display distance (optical gain). In general, the results showed that: (1) the facilitative effects on performance of increasing display magnification were apparently due to the concomitant reduction in field of view rather than to magnification *per se*; (2) differences in performance resulted from the same retinal magnification, contingent on the method used to obtain it; (3) display magnification had little effect on performance when used in conjunction with optical magnification. Author

N66-26178# Bureau of Mines, Grand Forks, N. Dak. Coal Research Lab.
CELL WITH FOUR VARIABLE COMPARTMENTS FOR RAPID INFRARED ANALYSIS
Willis Beckering, C. M. Frost, and W. W. Fowkes 1966 16 p refs
(BM-RI-6787)

The Bureau of Mines designed a cell having four variable compartments in series to facilitate analysis of multicomponent mixtures. Use of the cell considerably decreases the time required for differential absorption analyses. A solution of a major component is placed in each compartment, and the light absorbed by each of these components is varied by increasing or decreasing the path length of the appropriate cell. Simple calculations then establish the amount of the component present. In analyzing unknown mixtures, compensation is made for compounds known to be present, and the differential spectrum representing components not accounted for is recorded and analyzed. Author

N66-26287*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXPERIMENTAL ASSEMBLY AND STERILIZATION LABORATORY (EASL) OPERATIONS: PHASE I
G. F. Kapell, J. J. Mc Dade, and T. R. Gavin 15 Apr. 1966 30 p refs
(Contract NAS7-100)
(NASA-CR-75152; JPL-TR-32-941) CFSTI: HC $2.00/MF $0.50 CSCL 14B

This report describes the Experimental Assembly and Sterilization Laboratory (EASL) effort initiated early in 1965 at the Jet Propulsion Laboratory. This document also includes a discussion of the EASL facility, the EASL operations, the supporting operations, the operational results, and the problems encountered. In addition, this document, a final report of Phase I of the EASL effort, presents conclusions and recommendations based on this Phase I study. Author

N66-26361# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
DEVELOPMENT OF DESIGN STANDARDS FOR GROUND SUPPORT CONSOLES Final Report
K. W. Kennedy and C. Bates, Jr. Dec. 1965 55 p refs
(AMRL-TR-65-163; AD-630639) CFSTI: HC $3.00/MF $0.50

Experience gained in using a single standardized ground-support console configuration in the WS 131-B, Hound Dog, is discussed. Other ground console designs for possible standardization in future systems are described in detail. All designs are derived from a basic sit-stand configuration and will accommodate approximately 95% of the USAF male population and approximately 60% of the USAF female population. Each of the consoles can be made from five standard subassemblies. The suggested standard configurations permit engineering design freedom, yet restrict certain dimensional characteristics of the consoles to assure accommodation to the requirements and capabilities of the operator. Author (TAB)

N66-26471# Dow Chemical Co., Denver, Colo. Rocky Flats Div.
THE ROCKY FLATS BODY COUNTER
V. P. Johnson 12 Nov. 1965 11 p refs
(Contract AT(29-1)-1106)
(RFP-462) CFSTI: HC $1.00/MF $0.50 CSCL 14B

A body counting facility was completed for the detection of plutonium and uranium in humans. The facility includes two showers, a steel shield 8 by 9 by 8 feet high inside, and a crystal spectrometer. Author (NSA)

N66-26672# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
HYPERVELOCITY LAUNCHERS. PART 2: COMPOUND LAUNCHERS—DRIVING TECHNIQUES
I. I. Glass Dec. 1965 230 p refs
(Contract AF 33(615)-2766)
(UTIAS-26; AD-631065)

The critical survey of hypervelocity launchers and their research applications to reentry physics, hypervelocity impact, gasdynamics and aerodynamics, which was started in Part I (AD-419 112) is continued in the present report. The various subsections consider the improvements that may be obtained over a simple launcher by using chambrage, combustion drivers, piston compressors, and electrical discharges. It is shown that although significant but modest improvements are obtained, these techniques do not appear to offer actual and startling increases in muzzle velocities. Consequently, novel methods will have to be employed in order to achieve the desirable current hypervelocities of integral aerodynamic shapes at 50,000 ft/sec or greater. The application of implosion wave dynamics appears to offer such a possibility. Author (TAB)

N66-26743# Portugal. Nuclear Energy Commission, Sacavem. Laboratorio de Fisica e Engenharia Nucleares.
CONSTRUCTION AND UTILIZATION OF A SMALL SCISSION CHAMBER [CONSTRUCAO E UTILIZACAO DE CAMARAS DE CISAO DE PEQUENAS DIMENSOES]
Glenn S. Brunson, Luis Amaral Afonso, and Jose Francisco Salgado 1964 12 p refs In PORTUGUESE Presented at the 27th Portuguese–Spanish Conf. on the Progr. of Sci., Bilbao, Spain, 20–24 Jul. 1964
(LFEN-NI.19(α)) CFSTI: HC $1.00/MF $0.50

Some characteristics of gas detectors, such as the nature and influence of the circulating gas, and the collision rate variation in proportion to the discrimination or reactor power, are reported. Small scission chambers of uranium and thorium were constructed for the direct measurement of neutronic flux in areas in the nuclear reactor not easily accessible by other detectors. A block diagram shows the functioning and equipment of the neutronic flux gas detector. The ease of construction, the availability of construction materials, and the advantages of the linearity of response to the reactor power are summarized. Transl. by R.Ll.

N66-26812# Stanford Univ., Calif. Linear Accelerator Center.
TWO-MILE ACCELERATOR PROJECT Quarterly Status Report, 1 Jul.–30 Sep. 1965
Nov. 1965 109 p refs
(Contracts AT(04-3)-400; AT(04-3)-515)
(SLAC-53) CFSTI: HC $4.00/MF $0.75

The status of the Stanford Linear Accelerator and associated facilities is summarized, together with support activities. NSA

N66-26876*# Space Sciences, Inc., Waltham, Mass.
DEVELOPMENT OF A CONTINUOUSLY OPERATING SOURCE OF VACUUM ULTRAVIOLET AND SOFT X-RADIATION Final Report
[1965] 42 p refs
(Contract NAS5-3910)
(NASA-CR-75282) CFSTI: HC $2.00/MF $0.50 CSCL 20G

This final report describes the research and development of an intense vacuum ultraviolet and soft X-radiation source which provides line radiation at wavelengths less than 500 Angstroms. The method developed utilizes a vacuum arc where the arc is confined within a magnetic mirror field (Duo Plasmatron Type Source). With this source bright line spectra of Helium I and Helium II have been obtained. This report contains a summary of pertinent activities during the development program. The design of the instrumentation which is to be delivered to NASA is reviewed. Author

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N66-25386# Aeronautical Research Council (Gt. Brit.)
MEASUREMENTS OF SKIN-FRICTION IN AN ANNULUS BY THE FLOATING ELEMENT TECHNIQUE
J. K. White and R. E. Franklin (Oxford Univ.) London, HMSO, 1965 18 p refs Supersedes ARC-25661
(ARC-CP-814; ARC-25661) CFSTI: HC $1.00/MF $0.50

Details are given on the construction of an annular wind tunnel and a floating element drag balance designed to measure the skin friction on the inner convex surface of the annulus. The tunnel consists of a central core of 4 in. outside diameter aluminum tubing inside a brass tube of 6 in. inside diameter; care was taken in the assembly to avoid ridges at the joints of both inner and outer tubes, and to position the core centrally. Schematics of the drag balance and the circuitry are included. Experiments were conducted to examine the effect of gap width and pressure gradient on the readings obtained from the balance. Results are plotted to show the product of the balance currents against the reference pressure drop. These graphs, in conjunction with the equation for the force-sensitivity of the balance, show that the force measured by the balance is a linear function of the pressure drop. It was also demonstrated that the readings for several gap widths may be extrapolated to give the reading for zero gap width, and that, for sufficiently small gap widths, the instrument is unaffected by pressure gradients. M.G.J.

N66-25420# Institut Franco-Allemand de Recherches, St. Louis (France).
DAMPING OF SHOCK WAVES IN TUNNELS: EXPANSION CHAMBER AND NATURE OF WALLS
C. Thery, M. Oberle, and C. Laurent [1964] 40 p In FRENCH
(ISL-T-5/64) CFSTI: HC $2.00/MF $0.50

An experimental investigation was performed of the weakening of shock wave effects: (1) in a region neighboring a local enlargement of the tunnel, where lateral streaking occurs; and (2) due to the nature of the tunnel walls which cause wave form changes and pressure variations. It was established that the shock wave weakens instantly in its passage, but that the pressure increases noticeably and surpasses the pressure level existing behind the nonperturbed shock waves. Transl. by D.T.

N66-25473# Witwatersrand Univ., Johannesburg (South Africa). Dept. of Mechanical Engineering.
SHOCK WAVE DIFFRACTION, A REVIEW
B. W. Skews Jan. 1966 37 p refs
(Rept.-32) CFSTI: HC $2.00/MF $0.50

A literature survey is made of theories and researches relating to shock interactions, particularly with plane-walled corners. Theories advanced by Jones, Martin, and Thornhill and by Whitham are considered to be applicable to the case of shock diffracting at the corner of any angle. Attention is given to limitations of the theories, subsonic and supersonic flow, and various reports on shock diffraction. Linearization of the hydrodynamic equations is considered as the theoretical approach to the problem, and the interaction between a shock and an obstacle is discussed. Numerous illustrations show the density field, slipstream angle, secondary shock, and other aspects of shock diffraction. M.W.R.

N66-25568# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
BLUNT SLIPSTREAM CALCULATION USING THE METHOD OF INTEGRAL RELATIONS
D. R. Chenoweth Apr. 1965 22 p refs
(HREC-6-74-65-1; LMSC/HREC-A710967)

In the study of secondary injection thrust vector control, the primary and secondary flows, consisting of compressible but inviscid fluids, were calculated simultaneously using the method of integral relations for supersonic blunt blodies. In addition, both flows were assumed to be uniform, and the injected flow was steady and two-dimensional. The method, it is pointed out, allows direct calculation of the bow shock wave and the dividing stream surface. The first approximation, restricted to planar flows, is presented. It is recommended for future calculations that higher approximations be used in order to attain sufficient accuracy to render the method useful. D.T.

N66-25570# Lockheed Missiles and Space Co., Sunnyvale, Calif.
INFLUENCE OF THE TRANSVERSE FLOW VELOCITY IN AN INCOMPRESSIBLE BOUNDARY LAYER ON THE STABILITY OF THE LAMINAR FLOW MODE
Iu. N. Alekseev and A. I. Korotkin [1966] 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk. SSSR, Otd. Tekhn. Nauk: Mekh. Zhidk. i Gaza (Moscow), no. 1, 1966 p 32–36

The stability of a laminar boundary layer in the presence of a constant transverse velocity in the area near the wall (suction) was investigated. Calculations disclosed the existence of a relative suction velocity $v=v^0$ for the given velocity profile in the boundary layer, such that at suction velocities greater than v^0 the flow remains stable for all Reynolds numbers. It was found that when the fluid is sucked from the boundary layer, the instability domain is finite in size, i.e., lower and upper critical Reynolds numbers exist. The flow is stable if its Reynolds number is less than the lower or greater than the upper value of the critical Reynolds number. It is pointed out that the computational results permit an estimate of the relative suction velocity for velocity profiles from the Blasius to the asymptotic. Concrete computations were made for a family of Wuest profiles since an accelerated portion of the boundary layer always exists with suction under real conditions. D.T.

N66-25584*# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
NUMERICAL CALCULATIONS OF GAS-SURFACE INTERACTIONS
Richard A. Oman Washington, NASA, May 1966 53 p refs (Contract NASw-1027)
(NASA-CR-481) CFSTI: HC $3.00/MF $0.50 CSCL 20

Numerical calculations of gas–surface interactions at epithermal energies are correlated. The interactions were compared to the ideal FCC (100) surfaces at 0°K. It was concluded that (1) lattice surface structure and azimuth angle of incidence were found to be important only in the FCC (110) case; (2) a relatively simple correlation equation gives a prediction of energy exchanged with the lattice from known incident conditions; (3) absorbed contaminants were found to control the energy and momentum exchanges in most cases; (4) calculations of lattice thermal effects on the interactions indicate that this effect can usually be ignored; (5) statistical correlations are given which characterize momentum and spatial flux distributions as a function of incident conditions; and (6) the force pulse shapes giving the best correlation with calculated energy exchange were found to be much more sharply peaked than was expected. A tabulation of the results is included. N.E.N.

N66-25595# Institut Franco-Allemand de Recherches, St. Louis (France).
THEORY OF THE THERMAL BOUNDARY LAYER ON THE END WALL OF THE SHOCK TUBE [THEORIE DER TEMPERATURGRENZSCHICHT AN DER ENDWAND DES STOSSROHRES]
G. Smeets 2 Sep. 1964 39 p refs In GERMAN
(ISL-T-26/64) CFSTI: HC $2.00/MF $0.50

The law of energy and mass conservation was used to determine the temperature distribution resulting from the contact of hot gas with the cold wall of a shock tube. From this determination, the velocity of the flow produced by heat exchange was calculated, along with the heat transfer to the wall and the temperature of the wall. The results of the calculations are then discussed for an analysis of the boundary layer edge. Transl. by D.T.

N66-25604# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Freiburg (West Germany). Institut für Angewandte Mathematik und Mechanik.
STABILITY AND BRANCHING FOR STATIONARY SOLUTIONS OF NAVIER STOKES EQUATIONS IN THE TAYLOR PROBLEM [STABILITAT UND YERZWEIGUNG STATIONARER LOSUNGEN DER NAVIER-STOKESSCHEN GLEICHUNGEN BEIM TAYLOR-PROBLEM]
Sep. 1965 37 p refs In GERMAN, ENGLISH summary
(DLR-FB-65-61; DVL-477) CFSTI: HC $2.00/MF $0.50

It is shown that in the case of Taylor's experiment (rotating cylinders) there exists in addition to the Couette motion a further stationary solution of the full nonlinear Navier-Stokes equations for Reynolds numbers near the critical Reynolds number which is given as the smallest eigenvalue of the eigenvalue problem in linear stability theory. Mathematically there is a branching of stationary solutions where the Couette motion becomes unstable and, therefore, is physically not observable. Author

N66-25613# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
AN INDEX TO THE TWO-PHASE GAS–LIQUID FLOW LITERATURE, PART III
S. William Gouse, Jr. Jan. 1966 262 p refs (Contract Nonr-1841(73))
(DSR-8734-6; AD-630295) CFSTI: HC $6.00/MF $1.25

A total of 1,453 separate references on certain types of two-phase gas–liquid flow phenomena were found, verified, listed, and indexed by subject and principal author. This literature survey was carried out as one phase of a continuing program to determine the state of the art in two-phase gas–liquid flow phenomena. This is the terminal report of a program that has seen the publication of two prior indices, totaling 5,235 references on two-phase gas–liquid flow. The problem areas of condensation, cavitation, and atomization have been generally excluded, except through error or when references were of such a basic character as to be generally useful. A frequency of citation analysis was carried out to determine which of the 5,235 references have been most frequently cited. Author (TAB)

N66-25653# Institut Franco-Allemand de Recherches, St. Louis (France).
CONTRIBUTION TO THE STUDY OF THE ABSORPTION OF A SHOCK WAVE DIFFUSED IN A WALL FACED WITH A FLEXIBLE OR ROUGH MATERIAL. PRESSURE DISTRIBUTION BEHIND THE SHOCK WAVE [CONTRIBUTION A L'ETUDE DE L'AMORTISSEMENT D'UNE ONDE DE CHOC SE PROPAGEANT SUR UNE PAROI REVETUE D'UN MATERIAU FLEXIBLE OU RUGUEUX. DISTRIBUTION DES PRESSIONS DERRIERE L'ONDE DE CHOC]
M. Oberle 10 Nov. 1964 112 p refs In FRENCH
(ISL-6/64) CFSTI: HC $4.00/MF $0.75

In a study of the weakening of successive shock waves from a nuclear explosion, previous theoretical investigations are reviewed. These include: (1) the stability of a laminar flow on which are superimposed small perturbations; (2) the influence of wall flexibility on the stability of a laminar flow; (3) the influence of a nonstationary boundary layer existing behind a shock wave, on the attenuation of that shock wave. Present experimentation, using shock tubes, is also reported; and a short theoretical discussion of the shock is given. The methods of shadow photography and interferometry are described; and the results are presented in tabular and photographic form. Transl. by D.T.

N66-25868# Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
SUPERCAVITATING FLAT-PLATE WITH AN OSCILLATING FLAP AT ZERO CAVITATION NUMBER Final Report
C. S. Song Nov. 1965 69 p refs
(Contract Nonr-710(24))
(TR-52-B; AD-630353) CFSTI: HC $6.60/MF $0.75

The results of experimental and theoretical investigations on a supercavitating flat-plate with an oscillating flap at zero cavitation number are presented. The experiment was carried out in a vertical free-jet water tunnel using 3 in. chord and 2 in. chord flat-plate hydrofoils, both having flap–chord ratios of 0.29. Various relative locations of the free surfaces were used and the reduced frequency range of zero to four was covered. Amplitude and phase angle of lift, drag, and moment as well as the surface wave speed were measured. The problem was also solved analytically by means of a first order perturbation theory using complex acceleration potential. Numerical values were obtained for the cases of infinite fluid, symmetrical jet, and zero spray thickness using three flap–chord ratios (0.25, 0.30, 0.40). Fairly good agreement between the experimental data and the analytical results was obtained. Author (TAB)

N66-25874# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.

NUMERICAL SOLUTIONS FOR MERGING SHEAR FLOWS

N. Rott and R. J. Hakkinen Feb. 1965 40 p refs

(SM-47809; AD-470770)

This report presents the numerical results obtained in connection with an extensive study of initially uniform, infinite shear flows merging at the trailing edge of a semi-infinite flat plate. The representative cases chosen range from the merging of two identical flows above and below the plate, i.e., shear ratio of unity, to base flow, i.e., the lower flow initially at rest and the shear ratio equal to zero. The similarity analysis based on the boundary layer assumptions yields for each shear ratio a doubly infinite family of solutions, the free parameters being the magnitude of the induced pressure field and an arbitrary shift of the entire merging flow field in terms of the lateral similarity variable. For the first degree of freedom, two representative cases are chosen: no induced pressure field, and an induced pressure field corresponding to intersection of asymptotic velocity profiles at zero velcocity. The latter choice, combined with the freedom to choose the origin of the normal coordinate, permits the asymptotic velocity profiles to remain unshifted with respect to the free stream, corresponding to a condition first introduced by Li and Murray. Author (TAB)

N66-25890# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE EFFECT OF INITIAL TURBULENCE ON THE BOUNDARY AND THE LONG RANGE OF SUBMERGED STREAM

Yu. A. Shcherbina 17 Feb. 1966 9 p refs Transl. into ENGLISH from Tr., Fiz.-Tekhn. Inst. (Moscow), no. 7, 1961 p 152–157

(FTD-TT-65-1945/1+2+4; AD-630287) CFSTI: HC $1.10/MF $0.50

In sharply turbulated streams (to 30%), the basic laws of streams with normal initial turbulence are preserved. Audomodelive velocity takes place along the length of the stream and rectilinearity of the isotachs. When calculating turbulized stream boundaries, it is necessary to consider the increase in pole distance from the cut of the nozzles with a rise in initial turbulence. When calculating range of turbulated streams, it is necessary, together with the change in the value s, to take into attention the increase in the intensity of initial turbulence coefficient a with an increase in the intensity of initial turbulence. Experimental data are given of boundaries and long ranges of flat submerged streams, the initial turbulence of which varied from 6 to 30%. Calculation of such flow is possible with the aid of semiempirical theory of turbulent streams at a corresponding selection of semi-empirical constants. Given is a change in these constants with an increase in initial turbulence of the stream. Author (TAB)

N66-25906# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).

LOW DENSITY HIGH TEMPERATURE GAS DYNAMICS Annual Summary Report

J. J. Smolderen Jan. 1966 14 p refs

(Grant AF EOAR-65-13)

(AFOSR-66-0575; AD-629779) CFSTI: HC $1.60/MF $0.50

A summary is given of low density hypersonic flow research. Progress is reported on wind tunnel instrumentation based upon a technique which takes advantage of a periodic modulation of the flow to improve the signal=to-noise ratio of the instruments, which include hot wire probes and force measuring balances. Author (TAB)

N66-25920# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THICKNESS OF THE TURBULENT MIXING ZONE ON THE BOUNDARY OF TWO STREAMS OF GASES OF DIFFERENT VELOCITY AND DENSITY

O. V. Yakovlevskiy 18 Feb. 1966 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Energ. i Transp. (Moscow), no. 10, 1958 p 153–155

(FTD-TT-65-1928/1+2+4; AD-630411) CFSTI: HC $1.10/MF $0.50

A number of investigations of the relationship between the thickness of the turbulent mixing zone and its characteristic velocity are discussed. In addition, evaluations, in terms of the characteristic velocity, of the influence of the difference in density between the two gases on the thickness of the mixing zone is briefly examined. D.T.

N66-25928# Oklahoma State Univ., Stillwater. Coll. of Engineering.

FLOW STUDIES PROJECT AT OKLAHOMA STATE UNIVERSITY Final Report

E. Rune Lindgren Nov. 1965 10 p

(Contract Nonr-2595(05))

(AD-629895) CFSTI: HC $1.10/MF $0.50

The investigation concerns the mechanism that causes the observed drastic reduction of turbulent friction in flows of water by the presence of minute amounts of polyethylenoxide and other macromolecular additives. Author (TAB)

N66-25984# Hahn-Meitner-Institut für Kernforschung, Berlin (West Germany).

STATIONARY SUPERSONIC FLOW IN A COMMON CONE AND THE BASIS OF ITS NUMERICAL CALCULATION [STATIONARE UBERSCHALLSTROMUNGEN UM ALLGEMEINE KEGEL UND DIE GRUNDLAGEN IHRERNUMERISCHEN BERECHNUNG]

G. Bruhn Sep. 1965 59 p refs In GERMAN

(HMI-B-42; BM-23)

The problem of stationary supersonic flow in a common cone was formulated considering the special flow symmetry through the use of two independent variables. The basic assumptions are given and are represented in an integral form. The general non-isotropic case is considered. The case of constant entropy was studied as an approximation. Numerical calculations based on the equations derived are given. NSA

N66-26059# France. Ministere de l'Air, Paris.

STUDY OF THE INTERACTION OF SUPERSONIC JETS [ETUDE DE L'INTERACTION DE JETS SUPERSONIQUES]

Dietrich Faulmann Serv. de Doc. Sci. et Tech. de l'Armement, 1966 120 p refs In FRENCH

(Rept.-422) CFSTI: HC $4.00/MF $0.50

In an effort to determine the detachment distance of the shock waves of two flows, a small supersonic pipe was placed counter-current in a hypersonic wind tunnel. The detachment distance depends primarily on the ratio of the pressure generated by the pipe to the suspension pressure of the exterior hypersonic flow. In addition, the stability of the phenomenon was studied as a function of the ratio of the external diameter to the internal diameter of the supersonic pipe. Transl. by D.T.

N66-26089# Joint Publications Research Service, Washington, D. C.

THE RELAXATION ERROR IN MEASURING THE FLOW OF A FLUID BY THE METHOD OF NUCLEAR RESONANCE

A. I. Zhernovoy *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 8–17 refs (See N66-26086 14-14) CFSTI: $6.00

A theoretical evaluation is presented of the error made in measuring the flow velocity of a fluid using the nuclear resonance method. It is stated that this error is caused by the magnetic susceptibility of the nuclei. A diagram of the system considered is shown. In order the measure the flow velocity of a fluid in this system, a rapid polarization of the nuclei is performed at time t_1; and time t_2 is determined by the observed increase in the amplitude of the nuclear resonance signal. Using these and additional parameters, equations are derived for evaluating the relaxation error. It is shown that for cases of turbulent flow, it is sufficient to measure the time intervals at the instant when the signal amplitude reaches one half of the maximum magnitude. For laminar flows it was found necessary to record the time interval between the instant the marking fluid begins to flow, and the beginning of a change in the nuclear resonance signal; thus making it possible to determine the maximum velocity of the particles. H.S.W.

N66-26128# Joint Publications Research Service, Washington, D. C.

A STUDY OF THE OVERFLOWING OF GAS IN CONNECTING VESSELS

V. S. Ivlentiyev and G. V. Filipov *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 7–10 refs (See N66-26126 14-01) CFSTI: $3.00

Gas overflow from a vessel into a medium with variable pressure is considered, and a solution to the problem is proposed. The time during which the pressures in the vessels are equalized is determined, using an equation of state and the assumption that the process is isothermic. Equations are derived for obtaining the total time of equalization of the pressure in the vessels at the assumed geometric parameters of the system; conversely, they can be used to select the area of the aperture which will provide for the given time of equalization. M.G.J.

N66-26129# Joint Publications Research Service, Washington, D. C.

OPTIMUM PROBLEMS IN GAS DYNAMICS

T. K. Sirazetdinov *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 11–23 refs (See N66-26126 14-01) CFSTI: $3.00

A system of equations is derived for determining the optimum surface of a body having a minimum resistance or the capability of diffusing heat to the maximum degree possible (the quantity of heat passing through the surface of the body in a unit of time will be the minimum). The motion of a gas satisfies the Navier–Stokes equation, continuity, energy, and state. The equation of the profile of minimum resistance in a supersonic stream is considered in more detail. Author

N66-26135# Joint Publications Research Service, Washington, D. C.

AN APPROXIMATION METHOD OF CALCULATING A DETACHED BOW WAVE IN THE STREAMLINING OF BLUNT BODIES BY SUPERSONIC FLOW

B. S. Vinogradov and Z. G. Shaykhutdinov *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 72–77 refs (See N66-26126 14-01) CFSTI: $3.00

An approximate calculation method is proposed for determining the basic parameters of a bow wave, such as its dimension, distance from the nose of the body around which the flow is passing, and the flow after it. The assumptions upon which it is based are listed as (1) the approximation of the shock wave front generatrix by the equation of a hyperbola; (2) sonic barrier elements normal to the flow lines; and (3) no boundary layer formation on the surface of the body around which the flow is passing. A condition is also introduced in which the sound barrier is directed along the normal to the contour of the body around which the flow is passing. A flow diagram is given in which the system of coordinates is arranged so that the x-axis is oriented along the direction of the forward flow, and passes through the branching point at the nose of the body around which the flow is passing. Equations are derived, and in the first approximation the form and position of the shock wave are determined. Second approximation calculations are made, assuming five or six values of the coordinates of the points at the shock wave, and the calculated values of the pressure recovery factor are found. M.G.J.

N66-26138# Joint Publications Research Service, Washington, D. C.

ON THE CALCULATION OF THE PARAMETERS OF THE AIR BEHIND A DIRECT SHOCK WAVE WITH A CONSIDERATION OF THE STAGNATION TEMPERATURE INVERSION

Ye. G. Dolomanov *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 78–84 refs (See N66-26126 14-01) CFSTI: $3.00

A graphic–analytic method is described for calculating the thermodynamic and gas-dynamic functions of a gas behind a shock wave. Diagrams of state are used which automatically consider both the effect of the shock waves, and the effect of dissociation, ionization, formation of NO molecules, and variable heat content; cumbersome mathematical calculations are excluded. Figures depict the geometric interpretation of the differential effect of a shock; the calculation of parameters of the air behind a direct shock wave; and the existence of a stagnation temperature inversion in shock waves in the air. It was concluded that shock wave effect exists in all gases, and that each gas has its individual features. The point was also made that the accuracy of the calculation is dependent on the accurate representation of the stage of a real gas in the diagram used. M.G.J.

N66-26139# Joint Publications Research Service, Washington, D. C.

VARIATION IN THE VELOCITY DISTRIBUTION IN AN UNBROKEN CIRCULAR JET OF A FLUID

A. S. Lyshevskiy *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 106–112 refs (See N66-26126 14-01) CFSTI: $3.00

The requirements for establishing the quantitative relationships of velocity variations in an undisturbed jet of liquid are examined, and consideration is given to a jet of liquid flowing from an injector with round nozzle apertures. Flow regimes are reviewed, and it is pointed out that at a certain distance from the nozzle aperture, a uniform velocity distribution is established. The turbulent motion of the liquid in this section is described in detail; equations are derived; and solutions presented. Approximation equations are also given for the problem of laminar motion in an undisturbed jet of liquid. M.G.J.

N66-26140# Joint Publications Research Service, Washington, D. C.

THE CONNECTION OF THE WHEEL HEAD OF A RADIAL IMPELLER MACHINE WITH THE MOMENT OF INERTIA OF THE CORIOLIS FORCES

B. V. Ovsyannikov *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 113–125 refs (See N66-26126 14-01) CFSTI: $3.00

Computations are presented on the circulation of relative velocity around the blade of an axial impeller machine. Results show that the theoretical head of an axial impeller machine is proportional to the magnitude of the circulation around the contour blade, multiplied by the number of blades and the angular velocity of rotation. A connection is also found

between the pressure head and the circulation around the blades for a radial impeller machine. The theoretical head may be expressed by two terms: one determines the work of the forces associated with relative velocity circulation around the stopped blades; the other, the work of the moment of the Coriolis forces of inertia. Figures showing the pressure distribution and circulation flow are included. M.G.J.

N66-26241*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.

A STUDY OF LONGITUDINAL OSCILLATIONS OF PROPELLANT TANKS AND WAVE PROPAGATIONS IN FEED LINES. PART V: LONGITUDINAL OSCILLATION OF A PROPELLANT-FILLED FLEXIBLE OBLATE SPHEROIDAL TANK

Shoichi Uchiyama and Clement L. Tai 31 Mar. 1966 58 p refs (Contract NAS8-11490)

(NASA-CR-74854; SID-66-46-5) CFSTI: HC $3.00/MF $0.50 CSCL 20D

The present study describes an analytical method for determining the axisymmetric longitudinal mode shapes and frequencies of an incompressible and inviscid fluid contained in a pressurized, flexible oblate spheroidal propellant tank. Series expansions for the fluid velocity potential and the tank wall deflections are combined through the boundary conditions and shell equations of motion to obtain an eigenvalue problem whose solutions are the system frequencies and the coefficients of the series. In the analysis, the effect of the ullage gas pressure is included. This program will be directly applied to the present eigenvalue problem for the numerical solutions. Author

N66-26243*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.

A STUDY OF LONGITUDINAL OSCILLATIONS OF PROPELLANT TANKS AND WAVE PROPAGATIONS IN FEED LINES. PART III: WAVE PROPAGATION IN AN ELASTIC PIPE FILLED WITH INCOMPRESSIBLE VISCOUS STREAMING FLUID

Sui-an Fung and Clement L. Tai 31 Mar. 1966 35 p refs (Contract NAS8-11490)

(NASA-CR-74851; SID-66-46-3) CFSTI: HC $2.00/MF $0.50 CSCL 20D

The study of the longitudinal wave propagation in an elastic pipe filled with incompressible viscous fluid at rest has been extended to include the effect of steady stream. The Navier–Stokes equations are first introduced for an axisymmetric and incompressible flow. Linearization and simplification are obtained by the assumptions of small disturbance and small fluid viscosity. By linearizing the boundary conditions, the equations of motion of the pipe are greatly simplified and become linear. Perturbation technique is applied; the perturbed equations are solved by two transformations and the boundary layer method. Finally, based on the equations of motion of pipe and fluid and proper boundary conditions, a characteristic equation is formed in terms of phase velocity ratio and four independent parameters—viscosity parameter, steady-state velocity parameter, and the axial and radial inertia parameters. This fourth-order complex-valued characteristic equation is then separated, corresponding to real and imaginary parts, into two equations that are solved by digital computing. The method of numerical analysis and computing procedures are described in detail and some results are presented. Author

N66-26244*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.

A STUDY OF LONGITUDINAL OSCILLATIONS OF PROPELLANT TANKS AND WAVE PROPAGATIONS IN FEED LINES. PART IV: LONGITUDINAL OSCILLATION OF A PROPELLANT-FILLED FLEXIBLE HEMISPHERICAL TANK

Henry Wing and Clement L. Tai 31 Mar. 1966 35 p refs (Contract NAS8-11490)

(NASA-CR-74850; SID-66-46-4) CFSTI: HC $2.00/MF $0.50 CSCL 20D

A procedure has been formulated to determine the natural frequencies of an elastic liquid-filled hemispherical shell subjected to axisymmetric vibrations. It is assumed that the fluid is inviscid and incompressible, and its motion is assumed irrotational. Under these assumptions, a velocity potential is obtained from the solution of Laplace's equation in spherical coordinates. This velocity potential, together with Bernoulli's equation, permits the evaluation of the fluctuating fluid pressure at the interface. Treating the interface pressure as a force function in the shell equations, the shell displacement components are then determined analytically. The free surface boundary condition and the interface condition for the radial velocities can only be satisfied approximately. An eigenvalue problem is formulated by minimizing the integrated squared error for the interface condition subject to the constraints that the integrated error for the free surface condition also be a minimum, and the prescribed radial deflection along the edge of the shell be satisfied. Author

N66-26318# Wisconsin Univ., Madison. Mathematics Research Center.

APPLICATION OF A METHOD FOR APPROXIMATING EXTREMALS OF FUNCTIONALS TO COMPRESSIBLE FLUID FLOWS

Donald Greenspan and Padam Jain Jan. 1966 47 p refs (Contract DA-11-022-ORD-2059)

(MRC-597; AD-630534) CFSTI: HC $2.00/MF $0.50

A combination variational integral–finite difference technique for extremizing functionals numerically is applied to a fundamental, nonlinear subsonic flow problem. Not only is the flow pattern constructed, but estimates of the critical Mach number, speed, acceleration, and pressure are also obtained. The method is also applied to mark the emergence of a supersonic bubble in problems where this phenomenon occurs. Author (TAB)

N66-26323# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

NON-EQUILIBRIUM NOZZLE FLOW WITH CONDENSATION

Peter P. Wegener and Jean-Yves Parlange Mar. 1966 34 p refs Presented at the 7th AGARD Colloq. on Recent Advan. in Aerothermochem., Oslo, 16–20 May 1966

(Contract Nonr-609(47))

(Rept.-7; AD-630910) CFSTI: HC $2.00/MF $0.50

Condensation of vapor and vapor–gas mixtures in supersonic nozzle flows is discussed. The limiting conditions of equilibrium and frozen flow, and the thermodynamics of the collapse of the supersaturated flow are demonstrated. New results are presented on the nature of the condensate produced by homogeneous nucleation of water vapor in inert air. It is deduced from experiments that the condensate is finely dispersed after equilibrium is attained. Study of these extremely small clusters may shed new light on nucleation theory, surface free energy and other aspects of phase transition at low temperature. Author (TAB)

N66-26324# Wisconsin Univ., Madison. Mathematics Research Center.
APPLICATION OF INTEGRAL OPERATORS TO SINGULAR DIFFERENTIAL EQUATIONS AND TO COMPUTATIONS OF COMPRESSIBLE FLUID FLOWS
Stefan Bergman Jan. 1966 50 p refs
(Contract DA-11-022-ORD-2059)
(MRC-586; AD-630529) CFSTI: HC $2.00/MF $0.50

The application of the method of integral operators in the theory of partial differential equations is discussed. The operators transforming analytic functions f(u) of one variable into solutions of $D\psi=0$ and their inverses are described. A survey of results about the theorems which follow by transplanting relations in the theory of analytic functions of one and several variables is presented. Among others, theorems about approximation of a solution by linear combination are discussed. Here ψ_ν, $\nu=1, 2, \ldots$ is a set of particular solutions. The construction of the ψ_ν and application of this approach to the solution of the boundary value problems are presented. The equation arises in the theory of compressible fluids. The constructions of subsonic and transonic flows are described and examples are given. The use of the difference method in connection with the computation of flow patterns using the integral operator method is discussed.
Author (TAB)

N66-26326# Itek Corp., Palo Alto, Calif. Vidya Div.
CALCULATION OF LAMINAR SEPARATION WITH FREE INTERACTION BY THE METHOD OF INTEGRAL RELATIONS. PART II: TWO-DIMENSIONAL SUPERSONIC NONADIABATIC FLOW AND AXISYMMETRIC SUPERSONIC ADIABATIC AND NONADIABATIC FLOWS Technical Report, May–Oct. 1965
Jack N. Nielsen, Larry L. Lynes, and Frederick K. Goodwin Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Jan. 1966 91 p refs
(Contract AF 33(615)-1591)
(AFFDL-TR-65-107, Pt. II; VIDYA-203; AD-630765) CFSTI: HC $9.60/MF $0.75

A calculative method is presented for determining separated, laminar, boundary-layer characteristics from in front of the separation point to the reattachment point under the influence of 'free interaction' between the main flow and the boundary layer. The analysis covers supersonic flow over two-dimensional and axisymmetric configurations with adiabatic or nonadiabatic wall conditions. For nonadiabatic wall conditions, theories based on first-order coupling and second-order coupling between velocity and total temperature profiles were presented. The theory based on first-order coupling was included in a machine calculation program with options for two-dimensional or axisymmetric flow and adiabatic or nonadiabatic wall conditions. Extensive systematic calculations were made to determine the range of possible separated flows over a two-dimensional configuration as a function of separation point location and wall temperatures. Comparison between experiment and theory for separation pressure distributions on two-dimensional or axisymmetric adiabatic configurations shows generally good agreement.
Author (TAB)

N66-26394# Societe Nationale d'Etude et de Construction de Moteurs d' Aviation, Suresnes (France). Division Atomique.
SWIRL FLOWS IN BOILING WATER. HYDRODYNAMIC STUDY OF TWO-PHASE TWISTED FLOW REGIME IN A TUBE
A. Rosue and G. Tournier 15 Jul. 1965 47 p refs Transl. into ENGLISH from the French *Its* Spec. Rept.-20
(EURATOM-061-64-7 TEEF)
(EURAEC-1515; EUR-2667) CFSTI: HC $2.00/MF $0.50

Hydrodynamic tests with air and water at atmospheric pressure have enabled some aspects of twisted flow regime in a tube to be defined. The experimental tests are made in the range of velocities $0.75\ m/s<Vl_0<4m/s$. Pressure drop and void fraction measurements are in good agreement with those obtained in previous studies. Liquid velocity has a little influence on void fraction. Visualization, void fraction and electrical probe measurements were used to define the different flow patterns and water and air distribution in a channel cross section. In the range of very low qualities $x\leq 2.10^{-3}$ centrifugation of water becomes efficient at liquid velocity above 1 m/s. For qualities above $x\simeq 2.10^{-3}$ observed flow regimes with efficient centrifugation. Three flow patterns are defined: bubble flow, annular flow, mist annular flow. These flow patterns are different from those observed in straight flow, because the distribution of the two phases is not the same. A liquid film exists near the wall of the tube while air is more concentrated near the axis of the tube. A liquid film along the twisted tape was observed, but it is very thin and the liquid mass flow rate in this film is negligible compared to the liquid mass flow rate in the total cross section. The thickness of this liquid film is a function of the velocity and the quality.
Author (NSA)

N66-26407# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
CNOIDAL WAVES IN A TOROIDAL CHANNEL
Arthur S. Peters Feb. 1966 54 p refs
(Contract Nonr-285(55))
(IMM-347; AD-631121) CFSTI: HC $5.60/MF $0.50

The report is concerned with cnoidal waves in a liquid or gaseous ocean confined to a channel along a parallel of latitude on a sphere.
Author (TAB)

N66-26422# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Research Lab.
FORMULA FOR THERMAL ACCOMMODATION COEFFICIENT
Frank O. Goodman and Harold Y. Wachman Feb. 1966 44 p refs
(Grant NGR-22-009-121; Contracts AF 49(638)-1601; Nonr-3693(03))
(MIT Fluid Dyn. Res. Lab.-66-1; AFOSR-66-0295; AD-621007) CFSTI: HC $4.60/MF $0.50

A simple formula in closed form is proposed for the thermal accommodation coefficient from which the accommodation coefficient of a monatomic gas–solid system may be calculated from certain basic parameters of the system. The formula is obtained from consideration of certain aspects of Goodman's lattice theory of accommodation and from conclusions regarding certain properties of available experimental data. Adequate agreement is obtained of the formula with both the lattice theory and the experimental data. Certain corrections are applied to the lattice theory, and the gas–surface potential interaction parameters relevant to the lattice theory are revised.
Author (TAB)

N66-26506# Berlin Towing Tank (West Germany).
A GENERAL EQUATION OF MOTION FOR RIGID BODIES IN INCOMPRESSIBLE FLUIDS Final Report
Michael Schmiechen Sep. 1965 56 p refs
(Contract N62558-2552)
(AD-630085) CFSTI: HC $3.00/MF $0.50

Starting from the basic concepts of classical mechanics the general equation of motion for rigid bodies was developed. Laws of forces acting in the masses of the bodies and on the surfaces of bodies moving in incompressible fluids were established. Use was made of concise analytical matrix notation

which is essentially equivalent to, but more effective in operation than v. Mises' symbolic Motor-rechnung. In terms of this notation the complete equation for the motions of bodies in spaces moving with the surrounding fluids becomes extremely comprehensive. Thus it allows ready discussion of the physical phenomena represented, development of consistent equations for special cases, development of methods for the determination of the properties of the systems investigated and for the solution of the describing equations, and classification and critical reviews of former methods and results.
Author (TAB)

N66-26536# Army Missile Command, Huntsville, Ala. ARPA Div.
A GENERALIZED ASYMPTOTIC METHOD FOR THE SOLUTION OF REACTING LAMINAR BOUNDARY LAYER FLOWS. PART I: THREE-DIMENSIONAL FLOW OF AIR AT CHEMICAL EQUILIBRIUM NEAR A STAGNATION POINT
A. A. Hayday and D. A. Bowlus Jan. 1966 35 p refs
(RN-TR-66-2; AD-630270) CFSTI: HC $3.60/MF $0.50

In this report the asymptotic method is properly generalized and applied to the solution of the laminar boundary layer flow of dissociated air in the vicinity of a stagnation point on a general surface, S. The flow is considered to be in chemical equilibrium and belongs to the similarity class. Geometric considerations are manifested by a parameter c whose range is $0 \leq c \leq 1$, the two bounds corresponding respectively to the special cases of two-dimensional and rotationally symmetric flows. Basically, the solution of the example problems consists in solving several coupled nonlinear equations subject to specified boundary conditions (constant wall and stream enthalpy, equilibrium concentration of species at the wall and in the stream) and the choice of a preselected thermochemical model. The main reason for discussing general three-dimensional stagnation point flows, other than their technical importance, is to assess the accuracy of the asymptotic method in computing the flow field, local friction and heat transfer for a class of the 'simpler' problems. The test for $c=1$ is provided by the often quoted numerical results of Fay and Riddell. Care has been taken to reproduce their transport properties and their reaction model. (This is the only numerical work required.) In the special case of no reactions and constant properties, the earlier results of the authors, found to be in excellent agreement with the corresponding numerical solutions of Howarth, are recovered. These provide an auxiliary check.
Author (TAB)

N66-26560# Wisconsin Univ., Madison. Mathematics Research Center.
A HIGHER ORDER THEORY FOR DEEP WATER WAVES
Peter L. Monkmeyer and John E. Kutzbach Feb. 1966 37 p refs
(Contract DA-11-022-ORD-2059)
(MRC-610; AD-630544) CFSTI: HC $2.00/MF $0.50

The classical problem of describing the characteristics of deep water waves of finite amplitude is considered. The method of analysis initially follows that of Nekrasov, but differs in that a non-linear algebraic equation is derived. This equation is solved to the third, fifth and fifteenth order by means of a digital computer and the data is presented in tabular form. Expressions for the wave speed and wave shape, predicted by the analysis, are compared with the results obtained by Stokes. The highest wave in water is also discussed.
Author (TAB)

N66-26608# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics.
ON THE FLOW OF AN OSEEN-LIKE FLUID PAST A PARABOLOID OF REVOLUTION
Carl Kaplan Feb. 1966 27 p refs
(Contract AF 49(638)-496)
(AFOSR-SR-66-0173; AD-629577) CFSTI: HC $2.60/MF $0.50

The treatment of the problem of flow of an Oseen-like fluid past a paraboloid of revolution in three-dimensions follows closely the treatment of the corresponding problem for a parabolic cylinder in two-dimensions. The use of the concept of field modes reduces the problem to elementary considerations with no mathematical difficulties. Expressions for the components of fluid velocity at an arbitrary point in a meridian plane are obtained in closed form. The corresponding Stokes stream function is also obtained in closed form—the chief difference between this stream function and that for the parabolic cylinder being the replacement of the error function by the exponential integral. Expressions are derived for the shearing stress and the drag force and compared with the corresponding expressions for the parabolic cylinder.
Author (TAB)

N66-26619# Wisconsin Univ., Madison. Mathematics Research Center.
NUMERICAL STUDY OF A VISCOUS FLUID PAST A CIRCULAR CYLINDER
M. Kawaguti and Padam Jain Sep. 1965 52 p refs
(Contract DA-11-022-ORD-2059)
(MRC-590; AD-630530) CFSTI: HC $3.00/MF $0.50

A systematic numerical study of the unsteady viscous incompressible fluid flow past a circular cylinder is reported. The range of the Reynolds number considered is 1 to 100. The steady state solutions could be obtained at the Reynolds numbers R=10, 20, 30, 40, 50 as the limit of the unsteady state solutions. The numerical results are compared with those for the steady problem and they are found to be in agreement. Dependency on the Reynolds number and the time of the flow pattern, vorticity distribution, pressure distribution and the drag are shown.
Author (TAB)

N66-26626*# Israel Program for Scientific Translations, Ltd., Jerusalem.
NUMERICAL METHODS IN GAS DYNAMICS
G. S. Roslyakov and L. A. Chudov, ed. 1966 172 p refs Transl. into ENGLISH of the publ. "Chislennye Metody v Gazovoi Dinamike" Moscow, Izd. Mosk. Univ., 1963 p 1–166 Published for NASA and NSF
(NASA-TT-F-360; TT-65-50138) CFSTI: HC $5.00/MF $1.00 CSCL 20D

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N66-26627*# Israel Program for Scientific Translations, Ltd., Jerusalem.

SURVEY OF COMPUTATIONAL WORK ON STEADY AXISYMMETRIC GAS FLOW CARRIED OUT AT THE COMPUTATIONAL CENTER OF MOSCOW STATE UNIVERSITY

G. S. Roslyakov and G. F. Telenin *In its* Numerical Methods in Gas Dyn. 1966 p 1–11 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

Studies on the numerical computation of supersonic gas flow by the method of characteristics are reviewed, with consideration given to potential flow and eddy flow. Gas flow computations, which allow for physicochemical reactions, and procedural problems and organization of computation work are discussed. Methods for computing supersonic flow past bodies with separated shock wave are also surveyed. A reference bibliography is included. M.G.J.

N66-26628*# Israel Program for Scientific Translations, Ltd., Jerusalem.

ROUND-OFF ERRORS IN DIFFERENCE SOLUTIONS OF BOUNDARY-VALUE PROBLEMS FOR ELLIPTIC EQUATIONS AND SYSTEMS

L. A. Chudov and V. P. Kudryautsev *In its* Numerical Methods in Gas Dyn. 1966 p 12–32 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

Problems bearing on the evaluation of round-off errors and rational choice of grid spacing for one important class of difference schemes are investigated. A theoretical analysis is given for a model boundary value problem for the Laplace equation, in order to define a stable difference scheme for the problem and to prove the convergence of approximate solutions to the exact solution for stable approximating difference schemes. Equations are formulated, and the results which bear on the stability and convergence of the difference schemes are discussed; only two layer schemes are considered. It is pointed out that to reduce the effect of round-off and other analogous errors, grids should be used with as large a spacing as is feasible. A formula is given for a many-point scheme which meets these requirements. Comparative estimates of truncation and round-off errors for two difference schemes are derived for choosing the grid spacing with an error allowance, and a method is proposed for estimating the grid spacing for a gas dynamics problem. M.G.J.

N66-26629*# Israel Program for Scientific Translations, Ltd., Jerusalem.

CALCULATION OF AXISYMMETRIC EXHAUST NOZZLES WITH AN ALLOWANCE FOR EQUILIBRIUM PHYSICOCHEMICAL REACTIONS

U. G. Pirumov, V. A. Rubtsov, and V. N. Suvorova *In its* Numerical Methods in Gas Dyn. 1966 p 33–40 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

The problem of different gas flows in a nozzle of given contour is examined, along with the effect of the real gas properties on the coefficient of momentum losses in the exhaust nozzle. The method of characteristics for determining equilibrium gas flows is briefly described, and calculations are presented for equilibrium gas flows in a nozzle of given contour, and of nozzle contours ensuring uniform and parallel exit flow. Axisymmetric nozzles with an angular point were considered, and the effects of viscosity and heat conduction were neglected. The first nozzle was calculated by approximate formulas for ideal gas with $k=1.4$; the second nozzle was calculated exactly by the method of characteristics, and has uniform and parallel outlet flow for an ideal gas with $k=1.25$. The flow of real gas was calculated for both nozzles. To solve the mixed problem of the flow between the characteristic and the nozzle contour in the second nozzle, the method of characteristics was applied to ensure uniform and axisymmetric exit flow of an ideal gas with ratio of specific heats $k=1.25$. The results are analyzed, and graphs are included to depict the comparative data. M.G.J.

N66-26630*# Israel Program for Scientific Translations, Ltd., Jerusalem.

NUMERICAL COMPUTATION OF FLOW PAST A SCALARIFORM CONE

G. S. Roslyakov and N. V. Drozdova *In its* Numerical Methods in Gas Dyn. 1966 p 41–50 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

A numerical computation is made of the flow past a scalariform circular cone immersed in a supersonic stream of ideal

gas. It is assumed that the flow is uniform, the velocity vector of the incident flow is parallel to the axis of the body, while the flow velocity and the cone angles are such that the flow is supersonic at all points. It is also assumed that the angle of the second cone is larger than that of the first cone, so that a curvilinear compression shock is formed issuing from the jointing line on the surface of the body, as well as the conical shock in the frontal needle. In the region enclosed by the shocks the flow is self-adjusted. Beyond the second curvilinear shock the flow becomes turbulent, and its computation is very difficult. The turbulent region, with the exception of the jointing line, is computed by the method of characteristics. To determine the flow parameters near the jointing line, the results of an approximate theory were applied. Author

N66-26631*# Israel Program for Scientific Translations, Ltd., Jerusalem.

CALCULATION OF SUPERSONIC AXISYMMETRICAL JETS

T. G. Volkonskaya *In its* Numerical Methods in Gas Dyn. 1966 p 51–56 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

Attention is focused on subsonic jets or supersonic jets where the compression forms far downstream, i.e., cases where the shock need not be calculated. As methods of determining the shock with allowance for the transient conditions across the shock front are considered complicated, an alternate method is proposed in which the shock position is determined as the envelope of the intersection points of characteristics of one type. Correspondingly, the calculational procedure ignores the intersection characteristics of one type. The problem is formulated, and the method of characteristics is used to obtain a numerical solution only in the range of supersonic flow limited on its right by the first direct shock. Supersonic jets were also considered, with emphasis placed on procedures for numerically calculating the compression shock. A computer was used for the calculations, and the results are plotted graphically. M.G.J.

N66-26632*# Israel Program for Scientific Translations, Ltd., Jerusalem.

REVIEW OF BOUNDARY-LAYER STUDIES CARRIED OUT AT THE COMPUTATIONAL CENTER OF MOSCOW STATE UNIVERSITY

L. A. Chudov *In its* Numerical Methods in Gas Dyn. 1966 p 57–64 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

Some 30 numerical investigations of boundary-layer problems were carried out. These studies cover a very wide range, and besides their theoretical and methodical value most of them also have direct applied interest. The problems were solved by a variety of numerical methods (reduction to a system of ordinary equations, series expansions, difference methods, etc.). The reviewed solutions are grouped according to the computational procedures employed. Some points concerning the physical statement of the problems are occasionally discussed, but not the practical conclusions. Author

N66-26633*# Israel Program for Scientific Translations, Ltd., Jerusalem.

SOME SHORTCOMINGS OF CLASSICAL BOUNDARY-LAYER THEORY

L. A. Chudov *In its* Numerical Methods in Gas Dyn. 1966 p 65–73 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

The validity of applying the classical boundary layer theory to several problems is questioned, and examples are given as proof that further study is needed, particularly in cases of compressible gases. A solution is offered to the simplest case of viscous incompressible flow near a plane impermeable wall, in which a zero approximation is constrcured. A relationship is established between the equations obtained and the Prandtl equations, and the paradoxical behavior of v as $y \to \infty$ in the asymptotic Prandtl solution is explained. From this solution, procedures are detailed for constructing a continuous and smooth approximate solution valid in the entire flow domain. Equations and boundary conditions are derived, specifying the first approximation in the main domain. M.G.J.

N66-26634*# Israel Program for Scientific Translations, Ltd., Jerusalem.

A STANDARD PROGRAM FOR THE SOLUTION OF BOUNDARY-LAYER PROBLEMS

V. M. Paskonov *In its* Numerical Methods in Gas Dyn. 1966 p 74–79 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

Details are given on a standard computer program, developed for the numerical solution of boundary layer problems. A reduced form is given for a system of equations describing the flow of a viscous compressible gas in the boundary layer, with all the unknown functions depending on two space coordinates x, y. The system describes the boundary layer behavior for the oblique flow of a compressible gas past a cylinder or, with some approximation, for the gliding of a wing of finite span under conditions of zero lift; the flow in the wake is also described. It is pointed out that the class of problems considerably increases if the diverse boundary conditions which can be imposed on the system are considered. Several examples are given to show how the program enables the system to be integrated for various boundary conditions, coefficients, and dependence of density on the unknown functions or their derivatives. Use of the standard program also permits the application of certain difference schemes for solving nonstationary boundary layer problems. M.G.J.

N66-26635*# Israel Program for Scientific Translations, Ltd., Jerusalem.

BOUNDARY LAYER ON SLIGHTLY WAVY WALL

V. M. Paskonov and I. P. Soprunenko *In its* Numerical Methods in Gas Dyn. 1966 p 80–84 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

Solutions are briefly reviewed to the problems of potentials flow on a wavy wall with sinusoidal profile, and boundary layer flow on a slightly wavy wall. A criterion is expressed for the separation of the laminar boundary layer, and it was found that separation should first occur at $a_* = 0.0032$ at the point $\chi/\lambda = 0.52$ of the first ridge, and at $a_* = 0.0011$ at the point $\chi/\lambda = 1.515$ of the second ridge. Details are given on the use of the different methods to establish the values of a_* at which these ridge separations occur. Equations are formulated, and the standard computer program for solving boundary layer equations is used in the calculations. Figures are included to show the velocity profiles at each ridge separation, and the variations in boundary layer thicknesses. M.G.J.

N66-26637*# Israel Program for Scientific Translations, Ltd., Jerusalem.

BOUNDARY LAYER NEAR THE CRITICAL POINT

T. S. Varzhanskaya, E. I. Obroskova, and E. N. Starova *In its* Numerical Methods in Gas Dyn. 1966 p 94–101 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

An analysis is presented on the compressible laminar boundary layer near a critical point on a porous flat wall in a stream of air; it is assumed that hydrogen permeates through the wall at a constant rate. Boundary layer equations are formulated to allow for diffusion, and for boundary conditions. The system of partial differential equations near the critical point in the constant flow rate at the wall are reduced, and details are given on the iterative procedures used for its solution. The linear boundary value problems in each step are solved by the forcing method, and the equation is rewritten, with finite difference relations used to approximate the equation at the grid points. From these formulas the forcing coefficients are computed. Alternative methods—the two-layer implicit difference scheme—used in some solutions are also described. M.G.J.

N66-26638*# Israel Program for Scientific Translations, Ltd., Jerusalem.

NUMERICAL SOLUTION OF A BOUNDARY-VALUE PROBLEM FOR THE SYSTEM OF NONLINEAR INTEGRO-DIFFERENTIAL EQUATIONS OF A HYPERSONIC BOUNDARY LAYER

B. M. Budak, T. F. Bulatskaya, and E. P. Vasil'ev *In its* Numerical Methods in Gas Dyn. 1966 p 102–113 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

Equations are formulated for a hypersonic boundary layer on a slender body of revolution in a flow of viscous heat-conducting gas, and a boundary value problem for a system of nonlinear integro-differential Volterra equations is obtained. The difference–iterative method used in the solution is described, along with the difference approximations and the main stages of the computational process. A control calculation for the Blasius case was made to verify this numerical method, and the results are compared with previously published data. The method was also used in calculating alternative parameter and boundary values, and the numerical results obtained are plotted. It was concluded that the calculations made it possible to estimate the effect of the interaction of the boundary layer with the exterior stream on the pattern of flow past slender bodies at high supersonic velocities, over a wide range of flow conditions and parameter values. M.G.J.

N66-26640*# Israel Program for Scientific Translations, Ltd., Jerusalem.

NUMERICAL STUDY OF FLOW BETWEEN ROTATING CYLINDERS

A. L. Krylov and E. K. Proizvolova *In its* Numerical Methods in Gas Dyn. 1966 p 121–126 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

The following problem is considered: a viscous incompressible fluid is enclosed between coaxial cylinders of radii r_1, r_2 ($r_1 < r_2$) and unlimited height. When the cylinders rotate at angular velocities, then at certain relationships between the Reynolds numbers the simple stationary flow independent of angle and height becomes unstable and gives way to a different regime of stationary flow which, although still independent of the angle, periodically varies with height. A numerical analysis of the phenomenon is carried out for the general nonlinear formulation, in accordance with experiment. However, the flow is assumed to be periodic in height and axisymmetric. Author

N66-26641*# Israel Program for Scientific Translations, Ltd., Jerusalem.

STABILITY OF VISCOUS FLOW BETWEEN TWO ROTATING CYLINDERS

A. L. Krylov and A. F. Misnik *In its* Numerical Methods in Gas Dyn. 1966 p 127–131 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

Results are presented of numerical integration of the Orr–Sommerfeld equation for viscous fluid enclosed between rotating cylinders (Taylor flow). A neutral curve was plotted in the (R,λ) plane, where R is the Reynolds number of undisturbed flow, and λ is the frequency at which loss of stability occurs. The equation of stability of Taylor flow was found to reveal spectral properties which strongly differ from those of the equation of stability of Poiseuille flow. Author

N66-26642*# Israel Program for Scientific Translations, Ltd., Jerusalem.

APPLICATION OF DIFFERENCE SCHEMES TO COMPUTATION OF NONSTATIONARY FLOW OF VISCOUS INCOMPRESSIBLE FLUID

L. A. Chudov and T. V. Kuskova *In its* Numerical Methods in Gas Dyn. 1966 p 132–144 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

The problems encountered in computing two-dimensional nonstationary flow of a viscous incompressible fluid are discussed; and the need to devise model problems for evaluating effective difference methods, and for investigating such problems as choice of schemes, grid parameter determinations, and iterative processes is pointed out. An analysis is presented for a model equation, in which the choice of mesh size for certain difference schemes is studied. Some necessary concepts are defined, including the principal harmonic, the main rectangle, the characteristic time, and the accuracy standard. The stability of two two-layer difference schemes is considered, and errors of approximate solution in the principal harmonic are investigated for second order and fourth order accuracy. The time interval is also determined. To estimate the computational work involved in solving stability problems of viscous incompressible flow by the difference method, the problem of stability of Poiseuille flow is also considered. M.G.J.

N66-26643*# Israel Program for Scientific Translations, Ltd., Jerusalem.

CONVERGENCE AND ERROR ESTIMATES IN THE RAY METHOD FOR THE SOLUTION OF SOME SEEPAGE PROBLEMS

B. M. Budak and F. P. Vasil'ev *In its* Numerical Methods in Gas Dyn. 1966 p 145–165 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

The ray method is applied to a nonstationary or stationary problem which is reduced to an analogous mixed boundary value problem for a two-dimensional parabolic equation. The ray method is this case suggests itself as a natural combination of the plane method applied to the two-dimensional parabolic equation, and to the two-dimensional elliptic equation. Details are given on the bounded case only. The convergence of the solution of the difference–differential boundary value problem to the solution of the nonstationary differential boundary value problem is proven, and differential properties of this solution are investigated. A priori and a posteriori estimates of the error of the ray method are given. The analytical results are applied to nonstationary and stationary seepage. M.G.J.

N66-26659*# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.

CHOKED FLOW ANALOGY FOR VERY LOW QUALITY TWO-PHASE FLOWS Technical Report No. 18

Frederick G. Hammitt and M. John Robinson Mar. 1966 52 p refs *Its* Rept.-03424-18-T
(Grant NsG-39-60)
(NASA-CR-75127) CFSTI: HC $3.00/MF $0.50 CSCL 20D

Two theoretical models to predict axial pressure distribution, void fraction, and velocity in a cavitating venturi are applied. The theoretical predictions are compared with experimental data from cold water and mercury tests, and good agreement for the pressure profiles is found. The predicted void fractions are found to be too high, probably because the models assume zero slip or negative slip between the vapor and liquid phases. The analogy between the cavitating venturi and other choked flow regimes is explored. One of the theoretical models used is based on the assumption that the cavitating venturi is essentially entirely analogous to a deLaval nozzle operating in a choked flow regime with a compressible gas. The cavitating venturi is an example of an extremely low quality choked two-phase flow device. The present study is thus somewhat applicable to the study of liquid-cooled nuclear reactor pressure vessel or piping ruptures, which have received considerable attention in recent years. However, the qualities encountered in the present cavitation case are an order of magnitude lower than those usually considered for the reactor safety analyses, so that the present study is a limiting case for these. Author

N66-26667# Uppsala Univ. (Sweden). Inst. of Physical Chemistry.

NON-NEWTONIAN FLOW OF DILUTE POLYMETHACRYLIC ACID SOLUTIONS AT DIFFERENT DEGREES OF NEUTRALIZATION AND IONIC STRENGTHS Summary Report, 1 Jan. 1964–1 Jan. 1965

Ragnar Stromberg Wright-Patterson AFB, Ohio, AF Mater. Lab., Jan. 1966 25 p refs
(Contract AF 61(052)-392)
(AFML-TR-65-276; AD-630665) CFSTI: HC $2.60/MF $0.50

A careful experimental study of the gradient dependence of viscosity for dilute solutions of polymethacrylic acid (M= 112,000) was performed. Measurements were made at six degrees of neutralization between 10 and 90 percent and ionic strengths between 0.0005 M and 0.005 M. The velocity gradient range covered is 2–71,000/sec. Isoionic dilution was employed to permit linear extrapolation to zero concentration. As expected the gradient dependence is most pronounced when the polymer is highly charged and the ionic strength is low. The experimental results are mainly viewed in the light of theories concerning the rigidity of the macromolecular coil. Author (TAB)

N66-26712# Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.

FLOW STUDIES ABOUT BODIES AT LOW CAVITATION NUMBERS Final Report

Mar. 1966 5 p refs
(Contract Nonr-710(24))
(AD-630709) CFSTI: HC $1.10/MF $0.50

A brief summary is given of previous research under the contract and the respective Technical Papers are cited. TAB

N66-26837# California Univ., Berkeley. Div. of Applied Mechanics.

ON CONSTITUTIVE EQUATIONS FOR FLOW OF FLUID THROUGH AN ELASTIC SOLID

M. J. Crochet and P. M. Naghdi Jan. 1966 42 p refs
(Contract Nonr-222(69))
(AM-66-2; AD-630772) CFSTI: HC $4.60/MF $0.50

Some thermodynamical aspects of a restricted class of nonlinear constitutive equations for a mixture of two continua are discussed. These results are then specialized and further developed for the flow of fluid through an elastic solid and are applicable to problems of flow in porous media. The linearized constitutive relations for porous media, together with a simple example, are also discussed. Author (TAB)

N66-26842# Polytechnic Inst. of Brooklyn, Farmingdale, N. Y. Dept. of Aerospace Engineering and Applied Mechanics.

THE PLANE LAMINAR JET

Stanley G. Rubin and Robert Falco Jan. 1966 20 p refs
(Contract AF 49(638)-1623)
(PIBAL-963; AFOSR-66-0134; AD-629778) CFSTI: HC $1.60/MF $0.50

The plane laminar jet emanating from a point orifice is considered. The method of matched asymptotic expansions is used to determine higher-order 'inner' and 'outer' solutions, which are valid at some distance from the orifice. It is shown that the first-order 'inner' solution is non-unique, with respect to a small perturbation, and introduces an arbitrary constant. Higher-order solutions are obtained and the existence of additional arbitrary constants is predicted. It is seen that although axial viscous effects do not appear to second-order, the downstream momentum flux is variable due to a non-uniform pressure distribution. Author (TAB)

N66-26854*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

BINARY DIFFUSION IN AN EXPONENTIAL MEDIUM

Mordehai Liwshitz May 1966 52 p refs
(NASA-TM-X-55490; X-641-66-230) CFSTI: HC $3.00/MF $0.50 CSCL 01A

The equation of diffusion of a minor, light gaseous component through an exponential medium is examined in considerable detail. Its one-dimension version may be expressed in dimensionless units. The simple equation is, of course, a most idealized description of diffusion in the atmosphere. Nonetheless the coincidence of the time scales for vertical transport to the escape region, and the periodic variation there indicate that a realistic evaluation of the density profile of hydrogen or helium should, at the least, take into account the diurnal variation of conditions in the ambient atmosphere. It casts some doubt on models of diurnal variation constructed as a superposition of a periodic stationary density profiles. Author

N66-26856*# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.

COMPUTER PROGRAM FOR THE NUMERICAL SOLUTION OF NONEQUILIBRIUM EXPANSIONS OF REACTING GAS MIXTURES

V. A. Lordi, R. E. Mates, and J. R. Moselle Washington, NASA, May 1966 155 p refs
(Contract NASr-109)
(NASA-CR-472) CFSTI: HC $4.00/MF $1.00 CSCL 01A

This report describes a computer program for the numerical solution of quasi-one-dimensional, inviscid expansions of reacting mixtures. The details of the coding and operation of the program are discussed in this report. The computer program in its present form is capable of handling a general gas mixture, including up to 20 chemical species and 64 reactions. The species are assumed to undergo vibrational and electronic excitation in addition to coupled chemical reactions. The vibrational and electronic degrees of freedom are assumed to remain in thermodynamic equilibrium while the chemical reactions may be assumed to be either frozen, in equilibrium, or to proceed at finite reaction rates. Additional options in the program are provided for treating ionized nozzle flows, assuming the degree of vibrational excitation to be frozen at the reservoir value, or including the effects of moderate virial imperfections on high-density nozzle flows. While the basic program computes the properties of an expansion from an equilibrium reservoir state through a nozzle of specified geometry, modifications of the program have been made to permit specifying the stream-tube pressure variation rather than an area distribution and to permit a finite-velocity, equilibrium or non-equilibrium initial state. Author

N66-26885*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
AN ANALYTICAL STUDY OF SEPARATED FLOW ABOUT A CIRCULAR CYLINDER
B. H. Ujihara 25 Jan. 1966 149 p refs
(Contract NAS8-20140)
(NASA-CR-75253; SID-65-1730) CFSTI: HC $4.00/MF $1.00
CSCL 20D

Incompressible separated flow about a two-dimensional circular cylinder has been investigated on the basis of potential flow theory. It has been shown that the primary non-steady force characteristics can be adequately predicted in agreement with experimental data for subcritical Reynolds numbers, both for symmetrical flow and periodic vortex shedding. A detailed account is given of the fundamental investigations, including development of shear layer in flow past a half-plane, symmetrical flow past a 10:1 ellipse normal to the stream, and symmetrical and unsymmetrical flow past a circular cylinder. Author

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N66-25396# Institut Franco-Allemand de Recherches, St. Louis (France).
DIFFUSION OF AERIAL SHOCK WAVES OVER A TERRAIN WITH AN UNDULATORY PROFILE [PROPAGATION DES ONDES DE CHOC AERIENNES LE LONG DE TERRAINS DE COUPE SINUSOIDALE]
C. Thery and G. Kronenberger 3 Feb. 1964 48 p In FRENCH
(ISL-T-6/64) CFSTI: HC $2.00/MF $0.50

Two-dimensional shock wave propagation across an undulatory terrain was studied using a shock tube. Pressure measurements were performed on weak intensity shock waves by interferometry methods. In addition, weak and strong shock wave interactions were measured. The results are presented in graphic form. Transl. by D.T.

N66-25413# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131; 48°03"18'N, 07°35"24'E, OCTOBER-DECEMBER 1964 [IONOSPHAREN-DATA, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 131; 48°03"18'N 07°35"24'E, OCTOBER-DECEMBER 1964]
[1964] 126 p In GERMAN and ENGLISH
(Rept.-220-F; Rept.-221-F; Rept.-222-F) CFSTI: HC $4.00/MF $1.00

The ionospheric data for vertical echo sounding are presented in tabular form. An explanation is included of the codes used for machine computation, the units, coefficients, and variables. D.T.

N66-25414# National Observatory of Athens (Greece). Ionospheric Inst.
IONOSPHERIC OBSERVATIONS AND SOLAR RADIO EMISSION DATA, SCARAMANGA STATION (38°01"19,1'N AND 23°36"16,7'E)
Feb. 1965 40 p In GREEK and ENGLISH
CFSTI: HC $2.00/MF $0.50

Ionospheric observations and solar radio emission data are presented in tabular form. An explanation is included of the symbolism, qualifying letters, and units; and the measuring devices are briefly described. D.T.

N66-25477# Weapons Research Establishment, Salisbury (Australia).
THE STRATOSPHERIC AND MESOPHERIC CIRCULATION AT MID-LATITUDES OF THE SOUTHERN HEMISPHERE
Bryan Rofe Apr. 1966 255 p refs
(WRE-PAD-115) CFSTI: HC $6.00/MF $1.50

The results of sounding-rocket firings at Woomera (31°S) and Carnarvon (25°S) are presented. Seasonal variations to 320kft (97.5 km) in the basic atmospheric parameters, temperature, pressure, density and wind, are considered. An analysis of winds at Australian stations in the lower stratosphere is made. The quasi-biennial wave (QBW) determined is compared with the QBW determined for total ozone amounts. Author

N66-25484 Czechoslovak Academy of Sciences, Prague.
SYNCHRONIZED-ECOLOGICAL CHARACTERISTIC OF FLOODED GRASSLANDS IN SOUTHERN MORAVIA [SYNOKOLOGISCHE CHARAKTERISTIK DER SUDMAHRISCHEN UBERSCHWEMMUNGSWIESEN]
Emilig Balátová-Tuléčková 1966 49 p refs In GERMAN and CZECHOSLOVAKIAN *Its* Vol. 76, No. 1

Data on the phytosociological and synecological examinations of the Moravian river meadows are summarized, and tabulations are presented on evaluation of the genera *Caricion gracilis* and *Cnidion venosi*. These meadows, which are very fertile and among the best in the country, are still subjected to periodic flooding. The study focuses attention on the importance of these floodings, since they constitute the ecological factor that decisively influences the genera in the river meadows. Transl. by R.Ll.

N66-25485# National Physical Lab., New Delhi (India). Radio Propagation Unit.
CONTROL OF EQUATORIAL SPREAD-F BY THE F LAYER HEIGHT Scientific Report No. 25
B. C. Narasinga Rao 15 Dec. 1965 26 p refs
(RPU-S-25) CFSTI: HC $2.00/MF $0.50

The dependence of equatorial spread-F occurrence on the height of the F layer is examined in detail for two equatorial stations (Kodaikanal and Huancayo) lying close to the magnetic equator. The percentage of occurrence associated with different heights is found to vary with time, season, and longitude. The nocturnal variation of h'F on spread-F nights and nonspread-F nights suggests that h'F has to cross a threshold value of about 400 km for the production of spread-F. The percentage of occurrence is more during the period when h'F is decreasing than when it is increasing. These observations cannot be readily explained by the existing theories of spread-F in their present form. A probable mechanism, in which the spread F is caused by the plasma waves generated by the upward lifting of the layer across the horizontal magnetic field, is suggested to account for the observed features. Author

N66-25503# National Observatory of Athens (Greece). Ionospheric Inst.
IONOSPHERIC OBSERVATIONS AND SOLAR RADIO EMISSION DATA, SCARAMANGA STATION (38°01'19,1'N; 23°36'16,7'E), JANUARY 1965
Jan. 1965 40 p In GREEK and ENGLISH
CFSTI: HC $2.00/MF $0.50

This report presents graphical and tabular data from ionospheric observations and solar radio emission measurements for January 1965. The instrumentation used is briefly described. R.N.A.

N66-25504# National Observatory of Athens (Greece). Scaramanga Station.
IONOSPHERIC OBSERVATIONS AND SOLAR RADIO EMISSION DATA, SCARAMANGA STATION (38°01'19,1'N; 23°36'16,7'E), MARCH 1965
Mar. 1965 40 p In GREEK and ENGLISH
CFSTI: HC $2.00/MF $0.50

This report presents data from ionospheric observations and solar radio emission measurements in tabular and graphical form for March 1965. The instrumentation used is briefly described. R.N.A.

N66-25505# National Observatory of Athens (Greece). Ionospheric Inst.
IONOSPHERIC OBSERVATIONS AND SOLAR RADIO EMISSION DATA, SCARAMANGA STATION (38°01'19,1'N; 23°36'16,7'E), APRIL 1965
Apr. 1965 38 p In GREEK and ENGLISH
CFSTI: HC $2.00/MF $0.50

This report presents graphical and tabular data from ionospheric observations and solar radio emission measurements for April 1965. The instrumentation used is briefly described. R.N.A.

N66-25515# Naval Civil Engineering Lab., Port Hueneme, Calif.
SEA ICE STRENGTH STUDIES ON MCMURDO SOUND DURING THE AUSTRAL SUMMER 1964–1965
R. A. Paige and C. W. Lee Mar. 1966 27 p refs
(R-437; AD-630201) CFSTI: HC $1.00/MF $0.50

During the austral summer of 1964–65, a study of some of the physical properties of sea ice was made near McMurdo Station, Antarctica, where the sea ice is used extensively for aircraft operations, travel, freight hauling, and docking facilities. Tests of specimens showed that both shear and ring-tensile strengths increased almost linearly as specimen temperature decreased; the strength decreased as the ice sheet became warmer and more nearly isothermal. Average shear strength decreased from 140 psi in late October to a low of 90 psi in late January and then increased to 115 psi by 10 February just before breakup; average ring-tensile strength similarly decreased from 190 psi in mid-December to a low of 145 psi in early February, and then increased to 170 psi by 10 February. Internal deterioration and decrease in strength, thickness, salinity of brine, and temperature gradient are all related to rising temperatures and increased solar radiation during the summer. Development of a reliable method of predicting the bearing capacity of sea ice depends upon more detailed knowledge of the effects of loads, the history of the ice, danger zones and safety factors, and other features to insure safe operation on the ice. Author (TAB)

N66-25535# Joint Publications Research Service, Washington, D. C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 132
17 May 1966 36 p refs Transl. into ENGLISH from Russian
(JPRS-35558; TT-61-11147-132) CFSTI: $2.00

Abstracts of scientific articles and news reports are presented for Soviet-bloc research in the fields of astronomy, meteorology, oceanography, terrestrial geophysics, and upper atmosphere and space probe studies. News notes are included for a Soviet-Cuban oceanographic study, a conference on the tectonics of Siberia and the Far East, and some measurements of Venus. Meteorological abstracts deal with topics such as mapping, variability of elements, aerosol particles, and the geopotential for the natural synoptic period. Studies categorized under upper atmosphere and space research deal with atmospheric spectra, layers of the ionosphere, solar cells, and medical problems related to space flights. M.W.R.

N66-25536# Library of Congress, Washington, D. C. Aerospace Technology Div.
COSMIC NOISE ABSORPTION Surveys of Soviet Scientific and Technical Literature, 1964
16 Mar. 1966 88 p refs Compilation of abstracts
(ATD-66-25)

Abstracts are compiled for 68 articles on cosmic noise absorption which were taken from the Soviet open literature. Subjects covered include seasonal changes in ionospheric disturbances, atmospheric ionization and other activity in the E and F layers, solar flares and radio emissions, and related measurements and instrumentation. M.W.R.

N66-25619# Naval Research Lab., Washington, D. C.
IONOSPHERIC PARAMETERS DERIVED FROM ECHO II RADAR RETURNS DURING SOLAR MINIMUM CONDITIONS Interim Report
John M. Goodman 21 Feb. 1966 22 p refs
(NRL-6375; AD-630142) CFSTI: HC $1.00/MF $0.50

Radar returns from the Echo II satellite (1964-4A) were analyzed for Faraday rotation effects in order to ascertain their utility in deducing both the subsatellite electron content and the equivalent slab thickness of the daytime ionosphere. The following conclusions were reached: (a) The subsatellite electron content generally exhibits a large variance, but its average value tends to be largest near midday and decreases with increasing solar zenith angle. (b) The daily equivalent slab thickness exhibits no marked variation between 0800 and 1800 EST, although midafternoon values are somewhat in excess of prenoon values. (c) The seasonal equivalent slab

thickness has its minimum in local winter and its maximum in local summer; the equinox values are intermediate, with the autumnal equinox exhibiting higher computed values than the vernal equinox period. (d) The mean scale height Hs and the mean neutral gas temperature T for the ionosphere were found to be 94 km and 1582° K, respectively, during daytime hours. The daytime ionosphere was found to be 500° K warmer in summer than in winter, with the mean equinox temperature being close to the all-season average. (e) No pronounced correlation with Zurich sunspot number of decimetric solar flux was discernible, which was probably due to the fact that statistical variations in the observations exceeded the real variations which might have occurred as a result of solar activity changes. (f) No correlation with the magnetic index K was noted. These conclusions are based on radar echo data obtained during the recent period of minimum solar activity. Author (TAB)

N66-25620# Stanford Research Inst., Menlo Park, Calif.
THE IONOSPHERE BELOW 100 KM (D-REGION), A SIMPLE MODEL
E. T. Pierce and H. R. Arnold Sep. 1963 55 p refs
(Contract DA-36-039-SC-87197)
(RM-11; AD-630094) CFSTI: HC $5.60/MF $0.50

The parameters involved in the formation of the D region of the ionosphere are discussed in detail in an attempt to deduce the most reasonable values for them given our present knowledge of the ionosphere at heights of 40–100 km. The ionization due to solar radiation and from other sources, chiefly cosmic radiation, is also discussed and a model that includes the effect of solar cycle variations is derived. Several calculations, using the suggested values for the parameters, are made, including a comparison to an experimental profile for which the agreement is found to be remarkably good. Finally, mention is made of possible stratification due to winds and turbulence at D-region heights. Author (TAB)

N66-25631# France. Direction de la Meteorologie Nationale, Paris.
HYDROLOGIC DISTRIBUTIONS FOR 27 FRENCH WATER BASINS [BILANS HYDROLOGIQUES POUR 27 BASSINS FRANCAIS]
P. Caspar and J. Duclay Nov. 1964 45 p refs In FRENCH
Monographies de la Meterol. Natl., No. 49
CFSTI: HC $2.00/MF $0.50

In order to establish a firm basis for meteorological predictions, the hydrological balance of the principle flow basins in France was analyzed. The method of Thornthwaite was used to calculate the evaporation and transpiration potential in an effort to determine the hydrological balance and to fix the importance of its diverse phases. The precipitation and temperature data used was gathered from 1921 to 1950 at 70 different stations. The results of the analysis are given in tabular form, and meteorological and hydrological maps are included. Transl. by D.T.

N66-25636# Weapons Research Establishment, Salisbury (Australia).
DIURNAL VARIATIONS IN DENSITY, TEMPERATURE, PRESSURE AND WIND, BETWEEN 40 AND 90KM, IN THE SUB-TROPICAL LATITUDES OF THE SOUTHERN HEMISPHERE
Bryan Rofe, W. G. Elford, and Elizabeth M. Doyle (Adelaide Univ.) Apr. 1966 68 p refs
(WRE-TN-PAD-116) CFSTI: HC $3.00/MF $0.75

Data are presented relating to the firing of eight sounding rockets in Western Australia in May 1965. Measurements were made of the diurnal and semi-diurnal oscillations in atmospheric density, pressure, temperature, and wind; and wind velocities in the 70 to 100 km range were measured by meteor-drift techniques about 10° south of the firing station. Mean and periodic components of each parameter were determined as a function of time and height by a harmonic method and a model analysis. Both methods show significant amplitudes in the periodic components of the various parameters in the 34 to 100 km region. Above 70 km the amplitudes of pressure and meridional wind, both diurnal and semi-diurnal, show an approximately exponential increase. Pressure components at this height have amplitudes of about 10% of the ambient pressure. Tidal theory requires the zonal pressure wind and pressure to be 180° out of phase; for the diurnal component, this was 206° with a standard deviation of 82°; for the 12-hour component, it was 176°, with a standard deviation of 67°. Results are considered to imply more complex behavior than that required by a simple atmospheric tidal theory. M.W.R.

N66-25686*# National Aeronautics and Space Administration, Washington, D. C.
SPACE RESEARCH: TRANSACTIONS OF THE ALL-UNION CONFERENCE ON SPACE PHYSICS
G. A. Skuridin, Ye. L. Al'pert, V. I. Krasovskiy, and V. V. Shvarev, ed. May 1966 946 p refs Transl. into ENGLISH of the book "Issledovaniya Kosmicheskogo Prostranstva: Trudy Vsesoyuznoy Konferentsii po Fizike Kosmicheskogo Prostranstva" Moscow, Izd. Nauka, 1965 Conf. held in Moscow, 10–16 Jun. 1965
(NASA-TT-F-389) CFSTI: HC $8.35/MF $4.50 CSCL 04A

Conference papers summarizing research performed primarily by rockets and artificial earth satellites on the upper atmosphere, the ionosphere, radiation zones, interaction of solar corpuscular streams with the geomagnetic field, and physics of the sun and cosmic rays are presented. For individual titles see N66-25687–N66-25753.

N66-25687*# National Aeronautics and Space Administration, Washington, D. C.
CERTAIN PROBLEMS OF UPPER ATMOSPHERE PHYSICS AND SPACE NEAR THE EARTH
V. I. Krasovskiy *In its* Space Res. May 1966 p 8–25 refs
(See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Various phenomena encountered in the upper atmosphere are considered, and attention is given to the circulation processes at levels above 100 km. The interrelationships are stressed between such occurrences as warming and circulation of the atmosphere, photochemical conversions and ionization, atmospheric emissions, atomic and allotropic composition, periodic and sporadic geomagnetic variations, aurorae polaris and outer corpuscular streams, and radiation zones. The use of satellites and rockets as well as ground equipment is discussed for the study of these geophysical phenomena. M.W.R.

N66-25688*# National Aeronautics and Space Administration, Washington, D. C.
DENSITY AND TEMPERATURE OF THE ATMOSPHERE BASED ON MEASUREMENT RESULTS OBTAINED ON HIGH ALTITUDE GEOPHYSICAL AUTOMATIC STATIONS IN 1963
V. V. Mikhnevich *In its* Space Res. May 1966 p 25–34 refs
(See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Atmospheric density and temperatures were determined on the basis of data obtained from ionization and magnetodischarge manometers placed on high altitude geophysical automatic stations which were launched in 1963. It was confirmed that atmospheric density changes greatly at altitudes above 200 km, and that these changes are caused by a de-

crease in solar activity as well as by a diurnal effect. Atmospheric temperature recorded on May 18, 1963, was considerably less than during times of maximum solar activity. Analysis by various methods indicates that at elevations above 100 km, temperature increases monotonically when there is temperature inversion rather than when diffusion equilibrium exists. It is considered possible that temperature inversion does not always exist in the 100 to 300 km range of the atmosphere. M.W.R.

N66-25689*# National Aeronautics and Space Administration, Washington, D. C.
CERTAIN PROBLEMS ENTAILED IN STUDYING THE STRUCTURE OF THE UPPER ATMOSPHERE
M. N. Izakov *In its* Space Res. May 1966 p 35–49 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Attention is given to the study of the structural parameters of the upper atmosphere and their variations as indicated by various models. The dependence of temperature in the upper atmosphere and exosphere on the decimeter stream of solar radiation is graphed. According to calculations presented there is a large amplitude change in the diurnal temperature pattern with the solar cycle; and this is attributed to the small sample, the use of a barometric formula, and omitting the influences of thermal diffusion. The overall pattern of dependences, however, is found to be approximately the same for calculations made by the various models; differences which do occur between models emphasize the necessity of precise definitions for these dependences. M.W.R.

N66-25690*# National Aeronautics and Space Administration, Washington, D. C.
DYNAMIC NATURE OF ATMOSPHERIC DENSITY AT ALTITUDES OF 200–300 km
M. Ya. Marov *In its* Space Res. May 1966 p 53–61 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Analysis is made of data obtained from the braking of 14 Cosmos satellites, the first Soviet spacecraft–satellite and its cabin, and the third Soviet artificial Earth satellite. These data corroborate the dynamic nature of atmospheric density at altitudes between 200 and 300 km. Estimates of the atmospheric variation close to the thermosphere base have been derived for half of the solar cycle, and mean density is graphed for individual periods of the solar cycle at altitudes between 180 and 300 km. M.W.R.

N66-25691*# National Aeronautics and Space Administration, Washington, D. C.
COMPOSITION OF THE ATMOSPHERE IN THE 100–200 km REGION
A. D. Danilov *In its* Space Res. May 1966 p 62–65 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Experimental data indicate that molecular nitrogen is the main component of the atmosphere at altitudes up to 200 km, and evidence collected by the Explorer XVII satellite shows that nitrogen can dominate atmospheric content up to altitudes of 300 to 350 km. Results of various optical and mass spectrometric studies relating to atmospheric composition are reviewed. Nitrogen concentration does not exhibit any regular changes with time of day or with season, nor does the concentration vary significantly at altitudes between 100 and 200 km. Molecular oxygen concentration follows a similar pattern; but various data indicate that the oxygen–nitrogen ratio exhibits a diurnal variation, with an increase at midday. Since rocket data do not exhibit a diurnal variation for the nitrogen, the increase in the ratio is associated with an absolute increase in oxygen at noon. M.W.R.

N66-25692*# National Aeronautics and Space Administration, Washington, D. C.
UTILIZATION OF ARTIFICIAL EARTH SATELLITE ORBITAL DATA TO DETERMINE THE WIND VELOCITY IN THE THERMOSPHERE
B. N. Trubnikov *In its* Space Res. May 1966 p 66–73 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Consideration is given to the use of orbital variations of artificial earth satellites (AES) to obtain data on the wind velocity in the thermosphere. Equations of AES motion are written in the osculating elements, a formula is given to determine the earth's gravitational potential, and the aerodynamic force components influencing the AES are written. An index of thermospheric circulation is derived in terms of variation of the orbital elements of the satellite, and circulation data are summarized for the first five Soviet and American satellites. Lack of agreement between wind data obtained from rockets and from satellites can apparently be interpreted by the fact that the wind is determined in the perigee sector of the AES. Latitude and season of the atmospheric zone where the perigee is located, therefore, must be taken into account during wind velocity determination by orbital data. It is assumed that these wind observations are more representative than those of noctilucent clouds and ionospheric drifts. M.W.R.

N66-25693*# National Aeronautics and Space Administration, Washington, D. C.
AERODYNAMICS OF MANOMETERS AND MASS SPECTROMETERS CARRIED ON ROCKETS AND SATELLITES
A. I. Ivanovskiy *In its* Space Res. May 1966 p 74–80 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Means of calculating the ratio between a stream leaving a vacuum tube and the stream from the atmosphere are determined in connection with the study of the aerodynamics of manometers and mass spectrometers carried aboard rockets and satellites. The problem of determining equipment behavior in a stream of rarefied gas can be reduced to that of computing the Klausing factor for the tube. It is assumed that (1) the gas in the atmosphere is Maxwellian; (2) the particle, which is diffusely reflected, acquires the temperature of the wall against which it collides; and (3) the particle mean free path in the atmosphere is considerably greater than the linear dimensions of the equipment. Primary particles are those which do not collide with the wall, whereas the secondary particles do. The theorem is proposed that for a tube which is closed at the bottom, the intensity distribution is the same as for an infinitely long tube, which indicates that only the geometry from the input section to the ionization region is important for mass spectrometers. While formulas are derived for the case of particles which do not chemically react with the wall, a modification is offered to account for the fact that atomic oxygen in the upper atmosphere recombines into molecules at the wall; and the concept of a loss coefficient is introduced. M.W.R.

N66-25695*# National Aeronautics and Space Administration, Washington, D. C.
INFRARED SPECTROPHOTOMETRY OF THE EARTH'S THERMAL RADIATION
A. I. Lebedinskiy, D. N. Glovatskiy, V. I. Tulupov, B. V. Khlopov, A. A. Fomichev et al *In its* Space Res. May 1966 p 88–104 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Energy distribution in the thermal radiation spectrum of the Earth's atmosphere and underlying surface was studied by an infrared scanning diffraction spectrophotometer installed aboard Cosmos 45. Optics and kinematics of the instrument, which was calibrated by black body radiation, are

discussed and illustrated. Energy distribution in typical spectra in the 7 to 20 and 14 to 38 μ ranges are compared with black body curves, and latitudinal dependence of effective temperature is plotted at a wavelength of 9.5 μ from area scanning data. Derived spectra indicate very large and highly variable intensity of the ozone band centered at 9.6 μ; and latitudinal dependence of the relative depth of the ozone absorption lines are plotted. M.W.R.

N66-25696*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATING THE EARTH'S ATMOSPHERIC RADIATION IN THE VISIBLE AND ULTRAVIOLET REGIONS
A. I. Lebedinskiy, V. A. Krasnopol'skiy, A. P. Kuznetsov, and V. A. Iozenas *In its* Space Res. May 1966 p 105–119 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Measurements of night airglow and scattered solar ultraviolet radiation are reported for the Cosmos 45 satellite. A colorimeter operating on the night side made the former measurements, an ultraviolet spectrophotometer turned on during day side made the latter. While a significant part of the colorimeter data is distorted by lunar illumination, particularly when wideband filters were used, artificial sources of light did not exert a significant effect. Albedo of the cloudless terrestrial atmosphere is greatest in the near ultraviolet region around 3300 Å because of relatively little ozone absorption and a good deal of Rayleigh scattering. An attempt to utilize weather data to reconstruct the cloudiness picture gives limited results; average values of cloudiness over large areas are considered useable. For an average cloud albedo of 0.75, regardless of wavelength, average atmospheric albedo is 0.5 in the near ultraviolet and 0.4 for radiation in the visible region. M.W.R.

N66-25697*# National Aeronautics and Space Administration, Washington, D. C.
STUDY OF THE ANGULAR RADIATION DISTRIBUTION OF THE EARTH AND THE EARTH'S ATMOSPHERE FROM GEOPHYSICAL ROCKETS AND BALLOONS
M. N. Markov, Ya. I. Merson, and M. R. Shamilev *In its* Space Res. May 1966 p 122–126 (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

In order to measure the field of infrared radiation leaving the Earth, the angular radiation distribution was measured from the 0.8 to 40 μ spectral region by (1) rockets at altitudes between 100 and 500 km and (2) geophysical balloons at altitudes up to 30 km. The difference between these measured values and computed values is attributed to differences in actual weather conditions and those assumed for the computations. The effect of atmospheric radiation on outgoing thermal flux is considerably greater than would be assumed on the basis of existing concepts. Small-scale nonuniformities are not present on the curve for angular radiation distribution of the Earth, and the daily variations in this distribution curve are also insignificant. The climato-geographic conditions and seasonal variations have a more significant affect on recorded radiation intensity. M.W.R.

N66-25698*# National Aeronautics and Space Administration, Washington, D. C.
ANGULAR AND SPECTRAL RADIATION DISTRIBUTION OF THE EARTH IN THE INFRARED SPECTRAL REGION
P. A. Bazhulin, A. V. Kartashev, and M. N. Markov *In its* Space Res. May 1966 p 126–139 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Experimental determination of angular and spectral distributions are reported for geophysical rockets, and the apparatus used for these simultaneous measurements is described. A block diagram shows the impulse infrared spectrometer used for recording angular radiation distribution, and the transmission of various spectrometer channels is also illustrated. Dependence of emitter temperature on flux magnitude is shown for four spectrometer channels; and fluxes and effective temperatures are tabulated for a sighting direction of about 0.6 rad from the nadir. It is shown that in wide intervals of the infrared spectrum, the angular distribution curves correspond to radiation from a comparatively isotropic object; at narrower spectral intervals, the intensity fluctuations are much greater. Since the experiments were conducted on equipment with a narrow-angle optical system, it was possible to observe ionosphere infrared radiation which was concentrated in the 4.5 to 8.5 micron region. M.W.R.

N66-25699*# National Aeronautics and Space Administration, Washington, D. C.
DETERMINING TEMPERATURE AND MOISTURE OF THE EARTH'S ATMOSPHERE BASED ON SATELLITE MEASUREMENTS OF THE EARTH'S ATMOSPHERE
M. S. Malkevich and V. I. Tamarskiy *In its* Space Res. May 1966 p 140–152 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

A discussion is presented of problems involved in formulating a physical experiment for determining the temperature and moisture of the Earth's atmosphere by satellite measurements, and basic requirements and recommendations are proposed for such an experiment. A differential method is considered necessary to determine the deviations in vertical temperature and humidity profiles from the mean distributions; and black body radiation must be used for comparison purposes. An experiment is offered in which deviations in vertical profiles from the mean profiles can be obtained with an error of 30% of the mean quadratic deviation; and the differences in actual radiation from the Earth and the standard radiation can be measured with less than a 5% error, with a standard deviation error of 0.1%. M.W.R.

N66-25700*# National Aeronautics and Space Administration, Washington, D. C.
UPPER ATMOSPHERE LAYERS WHICH RADIATE IN THE INFRARED SPECTRAL REGION
M. N. Markov, Ya. I. Merson, and M. P. Shamilev *In its* Space Res. May 1966 p 153–162 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Terrestrial and atmospheric radiation measurements made by geophysical balloons and rockets from altitudes between 25 and 500 km are reported for the 0.8 to 40 μ infrared spectrum. Intense infrared radiation is observed from the atmospheric layers located at altitudes above 200 km, and radiations observed at altitudes of more than 250 km are primarily concentrated in the 2.5 to 8 μ spectral region. Radiation intensity was found to increase during periods of maximum solar activity. Results are also discussed for the amount of unbalanced radiation processes, the nature of the radiation detected, the isotropic stream of radiation found, and possible energy sources exciting the various layers. Various distributions are graphed; and it is noted that there was considerably greater radiation from the higher upper atmosphere layers during 1963, a year of maximum solar activity, than during years of a quiet sun. On the basis of limited results, it is stated that there is a correlation between the infrared radiation of the upper atmosphere and flares close to the central meridian of the solar disc. M.W.R.

N66-25702*# National Aeronautics and Space Administration, Washington, D. C.
CERTAIN RESULTS OF IONOSPHERE STUDIES USING ARTIFICIAL EARTH SATELLITES AND GEOPHYSICAL ROCKETS
V. A. Misyura, G. K. Solodovnikov, Ye. B. Krokhmal'nikov, and V. M. Migunov *In its* Space Res. May 1966 p 185–196 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Radiophysical studies of the outer ionosphere were made with recordings taken by the Cosmos XI satellite, Elektron I, satellite and some geophysical rockets. Measurements were made of differences in Doppler frequencies at coherent frequencies and of rotational Faraday effect at fixed frequencies. Local electron concentration was calculated along the satellite orbit, and this enabled the construction of an ionosphere profile for altitudes up to 2000 km. A non-monotonic concentration pattern was discovered above the F2 layer, and it is considered possible that these data indicate a new ionospheric layer above the F2 region. Electron concentration obtained here exceeds by a factor of approximately two the value calculated with a parabolic-exponential ionospheric model. Histogram and other data indicate that the dimensions of large-scale uniformities change to a lesser extent with solar activity than they do with time of day. M.W.R.

N66-25703*# National Aeronautics and Space Administration, Washington, D. C.
IONOSPHERE STUDIES BY RECEIVING AES RADIO EMISSION ON THE EARTH
L. M. Yerukhitov, N. A. Mityakov, and E. Ye. Mityakova *In its* Space Res. May 1966 p 196–201 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Preliminary results are reported for measurements made by the Elektron I satellite in the 20 to 90 Mc range in order to study the regular structure of the ionosphere, large-scale nonuniformities in the electron concentration, and small-scale ionospheric nonuniformities. Phase difference in signals of coherent frequencies were measured and the polarization fading of a 20 Mc signal was studied. In the phase difference recordings, nonregular changes caused by large-scale nonuniformities in the ionosphere were clearly apparent as were regular horizontal gradients of electron concentrations. These nonuniformities ranged from several to several hundred kilometers. Small-scale nonuniformities were found to have sharp diurnal variation, although they were mostly between one and two kilometers. Primary location of these nonuniformities was between 250 and 350 km. M.W.R.

N66-25704*# National Aeronautics and Space Administration, Washington, D. C.
BRIEF SURVEY OF THE RESULTS OF PHYSICAL EXPERIMENTS ON THE SATELLITE "KOSMOS-2" IN THE IONOSPHERE
V. V. Afonin, T. K. Breus, G. L. Gdalevich, B. N. Gorozhankin, K. I. Gringauz et al *In its* Space Res. May 1966 p 202–224 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Measurements made by Cosmos II satellite are considered to obtain information of the structure of the ionosphere and the processes which occur within it. Concentrations of positive ions and electrons as well as temperatures were measured at various altitudes between 212 and 1550 km. Details are presented of (1) distribution of positive ion concentration along the satellite orbit; (2) ion composition of transitional region from heavy ion (O^+) to light ion predominance; (3) electrical concentration and temperature measurements using cylindrical Langmuir probes; (4) positive ion temperature determination with honeycomb traps; (5) electron photoemission measurements along the satellite orbit; and (6) determination of the Cosmos II orientation with respect to velocity vector by using flat ion trap system. M.W.R.

N66-25705*# National Aeronautics and Space Administration, Washington, D. C.
RESULTS OF IONOSPHERE RESEARCH BY ROCKETS AND SATELLITES IN 1960–1964
B. N. Gorozhankin and V. A. Rudakov *In its* Space Res. May 1966 p 225–238 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

A review is presented of measurements of electron and ion concentrations in the ionosphere made by various rockets and satellites at altitudes as high as 2000 km. Methodology employed in making these measurements is emphasized, and parameters measured by Soviet and United States satellites are included. It is concluded that high altitude rockets give the most reliable and accurate measurements of charged particle concentrations. Radio interference methods to study the ionosphere from satellites produce some difficulties, while the use of ion traps simplifies processing. The dependence of altitude distribution of charged particles above the F layer maximum on solar activity is mentioned; and satellite radio probing is considered the only method which permits the derivation of altitude distributions of electron concentrations which are practically free from the influence of horizontal gradients. M.W.R.

N66-25707*# National Aeronautics and Space Administration, Washington, D. C.
ROCKET DATA ON THE BEHAVIOR OF ELECTRON CONCENTRATION IN THE IONOSPHERE AT ALTITUDES OF 100–300 km
T. V. Kazachevskaya and G. S. Ivanov-Kholodnyy *In its* Space Res. May 1966 p 248–258 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Characteristics of electron concentration changes at altitudes between 100 and 300 km are considered in a review of measurements made by direct rocket probes of the ionosphere. It is noted that there is a significant difference between concentrations in winter and summer, and the changes are dependent upon the solar activity phase for all altitudes. Diurnal variations differ with altitude and seasons. Data indicate the existence of an ionization source during the nighttime at altitudes between 100 and 200 km. The altitude of the base of the E region is found to be dependent upon the season, and there are decreases in this altitude with increases in geomagnetic activity. Altitude of the F layer at midday is greater during summer and fall than during winter, and this layer's altitude is also dependent upon solar activity. Diurnal variations in F layer altitude are attributed to variations in temperature, ionization rate, and atmospheric composition. M.W.R.

N66-25719*# National Aeronautics and Space Administration, Washington, D. C.
INTENSIFICATION OF THE OUTER ELECTRIC FIELD ON THE SURFACE OF A LARGE BODY IN THE IONOSPHERE
L. L. Goryshnik and A. N. Dyukalov *In its* Space Res. May 1966 p 360–365 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Dependence of field strength on the surface of a body in the ionosphere upon a weak outer electric field is investigated. A stationary body in an infinite plasma is analyzed in which there is a weak constant electric field but no magnetic field; and computations are given for the amplification factor of the electric field on the ionospheric body. Photoeffect and secondary emission are disregarded; and, because the isolated body

acquires a negative potential due to electron mobility, the difference between body and unperturbed plasma significantly increase the mean thermal electron energy. A space charge layer is, therefore, formed close to the body; and this layer and its boundary is investigated. M.W.R.

N66-25720*# National Aeronautics and Space Administration, Washington, D. C.
ELECTRIC FIELDS IN THE IONOSPHERE BASED ON DATA FROM DIRECT MEASUREMENTS ON GEOPHYSICAL ROCKETS
G. L. Gdalevich and I. M. Imyanitov *In its* Space Res. May 1966 p 367–372 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Electrostatic fluxmeters aboard geophysical rockets have been used to make direct measurements of electric field strength in the ionosphere. The large measured values recorded are considered to affect ionospheric characteristics, lead to the drift of ionization nonuniformities, and produce luminescence of the oxygen lines due to a general increase in the charged particle temperatures. Speculations are made with regard to two questions: (1) What is the source of the strong electric fields? (2) Why don't such strong fields cause extreme heating of the ionosphere? M.W.R.

N66-25752*# National Aeronautics and Space Administration, Washington, D. C.
EXPERIMENTS UNDER THE PROGRAM OF THE WORLD MAGNETIC SURVEY
Sh. Sh. Dolginov, V. I. Nalivayko, A. V. Tyurmin, and M. N. Chinchevoy *In its* Space Res. May 1966 p 806–816 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

This article discusses the proposed World Magnetic Survey project which is designed to measure the earth's magnetic field using the different means available and at different levels from the earth's surface. The advantages of a satellite magnetic survey are examined and magnetometric equipment of the Kosmos 26 and 49 satellites are described. Geomagnetic data from these satellites in the form of a magnetogram and two magnetic charts in the 270–404 km range are included along with plans for research on the geomagnetic field. R.N.A.

N66-25771# International Centre for Theoretical Physics, Trieste (Italy).
A MODEL FOR THE INFLUENCE OF THE EARTH MAGNETIC TAIL ON GEOMAGNETIC PHENOMENA
B. Coppi, G. Laval, and R. Pellat 31 Dec. 1965 14 p refs Submitted for Publication
(IC/65/93) CFSTI: HC $1.00/MF $0.50

A model is presented to provide a quantitative interpretation of the observed processes of electron acceleration and magnetic field fluctuations. The order of magnitude of the growth time for the magnetic tail can be determined by establishing a balance between these two types of energy. By using measurements obtained by the IMP-I satellite it is shown that growth time is not very sensitive to electron temperature. In fact, it is stated that there is no available theory to describe the nonlinearity of this instability and the resulting particle acceleration. The results of the instability are the reconnection of magnetic field lines at the end of the sheet which is nearer the Earth, and the acceleration of electrons on the ecliptic plane. Acceleration is shown to be maximum at the nodes where the magnetic field lines are reconnected. If the auroral substorm phenomenon can be associated with the instability of the neutral sheet, the recovery time of the substorm may be related with the time required to reform the sheet. M.W.R.

N66-25776# Library of Congress, Washington, D. C. Aerospace Technology Div.
DIURNAL VARIATIONS OF DENSITY, PRESSURE, AND TEMPERATURE IN THE ATMOSPHERE Surveys of Soviet Scientific and Technical Literature
Edward J. Osten 1 Apr. 1966 18 p Transl. into ENGLISH from the book "Komissiya po Issledovaniyu i Ispol'zovaniyu Kosmicheskogo Prostranstva" Moscow, Izd-vo Nauka, 1965 p 39–41
(ATD-66-36)

A linear solution based on the theory of tides in the atmosphere is proposed to explain diurnal fluctuations of density, pressure, and temperature in the atmosphere. The proposal is analyzed mathematically, and preliminary results indicate a dependence of amplitude and phase on heights from 100 to 200 km. It is concluded that this means the dynamic characteristics at these heights have considerable influence on the processes which take place; and the energy balance of the upper atmosphere is determined not only by absorption of solar radiation, heat conductivity, but also by the fluctuating properties of the atmosphere itself. The author says that further refinements are required for this theory. M.W.R.

N66-25781# Joint Publications Research Service, Washington, D. C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 128
16 Mar. 1966 69 p refs Transl. into ENGLISH from Russian
(JPRS-34593; TT-61-11147-128) CFSTI: $3.00

Soviet-bloc research relating to astronomy, meteorology, oceanography, terrestrial geophysics, and the upper atmosphere and space technology is reported in the form of abstracts of scientific papers and new articles. Details are given for the landing of Luna 9 on the moon, and some notes are included on an Antarctic expedition. M.W.R.

N66-25822# France. Ministere de l'Air, Paris.
ON THE TOTAL ECLIPSE OF THE SUN OF 15 FEBRUARY 1961. A CONTRIBUTION TO THE ANALYSIS OF ATMOSPHERIC HEAT [A PROPOS DE L'ECLIPSE TOTTALE DE SOLEIL DU 15 FEVRIER 1961. ESSAI DE CONTRIBUTION A LA THERMIQUE DE L'ATMOSPHERE]
F. M. Camia (Centre Natl. de la Rech. Sci., Marseilles, France) Serv. de Doc. Sci. et Tech. de l'Armament, 1965 41 p refs In FRENCH
(Rept.-420) CFSTI: HC $2.00/MF $0.50

The atmospheric conditions observed in southwestern France during the total eclipse of 15 February 1961 were investigated. A period of calm and transparence was in evidence, justifying the comparison of this day's thermograms with those of the day before and the day after. In addition, a hypothermia consecutive to the eclipse was in evidence. The various possible causes of this event, disclosed by sheltered thermometers, were sought. It is shown that there exists a definite, out-of-phase connection with the hypothermia of the earth. This displacement can only be explained in a broad sense as a result of conduction (pure conduction mixed with convection) in the air in contact with the earth. Some local disturbances, however, can be interpreted as an effect of haze. Transl. by D.T.

N66-25825# India. Dept. of Atomic Energy, Bombay.
SOME ASPECTS OF FALLOUT FROM THE FIRST AND SECOND CHINESE TESTS
K. G. Vohra 1965 19 p refs
(AEET-240) CFSTI: HC $1.00/MF $0.50

The pattern of movement of fallout debris clouds after the first and second Chinese tests has been studied with the help of wind data at 200 mb level. Samples of fallout debris collected at high altitudes with the help of commercial aircraft

have been studied for freshly produced fission products and detailed analysis has been carried out for several shortlived isotopes. Details of analysis used for rapid identification of fissile materials after the two tests are presented. Activity ratios of important shortlived fission products for both of the tests had shown U-235 fission. The results of analysis for Np-239 and U-237 are also given. These analyses provide evidence of production of U-237 by double neutron capture and of Np-239 by neutron activation of U-238. The airborne radioactivity found at Gulmarg after the second Chinese test has been discussed. Author

N66-25892# Teledyne, Inc., Alexandria, Va. Earth Sciences Div.
APPLICATIONS AND DEVELOPMENT OF POLARIZATION (REMODE) FILTERS
James N. Griffin 4 Apr. 1966 114 p refs
(Contract AF 33(657)-15919; ARPA Order 624; Proj. Vela Uniform)
(SDL-141; AD-630515) CFSTI: HC $4.00/MF $0.75

Polarization filters, designed to detect rectilinear orbital motion recorded on 3-component seismograms, were applied as aids in the detection and identification of the phases pP and sP from eight large teleseismic earthquakes. The filters were designed to pass the frequency bands corresponding to any motion which is at least moderately rectilinear along any direction within a vertical quadrant from which the phases were expected to arrive. Experimental filters of higher selectivity, more appropriate to detecting weak signals in signal generated noise, were demonstrated in a few examples. Author

N66-25895# Naval Civil Engineering Lab., Port Hueneme, Calif.
REFRACTION OF DISPERSIVE WAVES ON A BEACH
J. R. Evans and D. G. True Jun. 1965 27 p refs
(N-738; AD-618876) CFSTI: HC $2.00/MF $0.50

Refraction of dispersive type waves on a beach is predicted adequately by use of Snell's Law. Amplitudes of the refracted waves on a beach are predicted adequately by a modified form of Green's Law when the amplitude at one point '7' e.g., the toe of the beach, is known. Author (TAB)

N66-25955# Wisconsin Univ., Madison. Dept. of Mathematics.
WATER WAVES AT THE SHORELINE
Albion D. Taylor 15 Jul. 1965 60 p refs
(Contract Nonr-1202(27))
(TR-1202(27)/3; AD-478688)

The nonlinear equations of two-dimensional wave motion on a shallow beach are used to study motions starting from rest and developing so that the surface elevation, at a fixed distance from the initial shore position, approaches rapidly an approximately simple-harmonic function of time. The Laplace transform is applied to a related problem and is inverted to obtain the solution of the physical problem when the water motion is bore-free. It is shown, moreover, that the solution does represent a bore-free motion for sufficiently small, non-zero amplitude, except at a set of resonant frequencies. Author (TAB)

N66-25961# Franklin Inst., Philadelphia, Pa. Research Labs.
RESEARCH IN SURVEYING, MAPPING, AND GEODESY APPLICATION OF CORIOLIS FORCE TO GEODETIC MEASUREMENTS Interim Report
George Peter Wachtell Dec. 1965 55 p refs
(Contract DA-44-009-ENG-3767)
(I-A2217-7; AD-477136)

The Coriolis force may be used to determine true North. Following general principles and accuracy considerations, mechanical devices are discussed. These include a modified Foucault pendulum, vibrating masses, the Foucault directional gyroscope, and a cross-shaped vibrator. The possibility of using the human ear as a sensitive detector is also suggested. Devices based on fluid motion, as well as some other devices described in the literature, are discussed. Author (TAB)

N66-25965# Columbia Univ., New York.
QUICK CLAY MOVEMENTS, ANCHORAGE, ALASKA Scientific Report No. 5
Paul F. Kerr and Isabelle M. Drew Dec. 1965 139 p refs Preliminary Rept.
(Contract AF 19(604)-8387)
(AFCRL-66-78; AD-630111) CFSTI: HC $4.00/MF $1.00

The earthquake on March 27, 1964, at Anchorage, Alaska caused major destruction and loss of life. Within the city of Anchorage and nearby, major damage resulted from earthquake vibration. However, greatly intensified destruction was brought about by landslides or sinking land. Preliminary accounts suggested the possibility that movements in sensitive clay masses widely distributed in underlying strata were responsible for much of the Anchorage deformation. This paper describes observations on the Anchorage clay, the earth movements which followed the earthquake, and nearby slides of earlier and perhaps similar origin. TAB

N66-26051# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131; 48°03"18'N, 07°35"24'E, JANUARY-MARCH 1965 [IONOSPHAREN-DATA, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 131; 48°03"18'N 07°35"24'E, JANUAR-MARZ 1965]
[1965] 133 p In GERMAN and ENGLISH
(Rept.-223-F; Rept.-224-F; Rept.-225-F) CFSTI: HC $4.00/MF $1.00

Tables of the hourly values of the customary ionospheric parameters, obtained by vertical echo sounding, are given for the station at Freiburg, West Germany, for January, February, and March, 1965. Transl. by K.W.

N66-26166# Defence Research Board, Ottawa (Ontario). Directorate of Scientific Information Services.
STRUCTURE OF RIVER ICE
P. S. Vadilo Jan. 1966 7 p refs Transl. into ENGLISH from Prirodа (Moscow), v. 3, 1951 p 52-53
(T-449-R) CFSTI: HC $1.00/MF $0.50

The crystal structure of ice and methods of determining its structure are important since the melting rate of ice depends on its structure. This article presents a convenient method for bringing out the structure of ice. Ice at a temperature below 0°C is subjected to the action of moist air. This is done by placing the ice over boiling water or by blowing one's breath on it. This results in the formation of fine, often microscopic, faceted crystals. The orientation of these crystals corresponds to the orientation of the river ice monocrystals upon which they are formed. Some of the results obtained in using this method to study the structure of ice from different rivers are discussed. R.N.A.

N66-26172# Library of Congress, Washington, D. C. Aerospace Technology Div.
ELECTROMAGNETIC WAVE PROPAGATION AND THE UPPER ATMOSPHERE Surveys of Soviet Scientific and Technical Literature
11 Feb. 1966 88 p refs Compilation of Abstracts
(ATD-66-15)

This compilation of abstracts is based on Soviet-Satellite open sources published 1964–1965. It is the first in a series of reports reviewing Soviet research on electromagnetic wave propagation and the upper atmosphere. Information not directly related to the assigned subject has been included because of its broad implications for study in this field. The 85 entries are arranged alphabetically by author within each of the following categories: ionosphere and EM wave propagation (27 entries), solar and cosmic radiation effects on the ionosphere and the geomagnetic field (34 entries), geomagnetism and whistlers (13 entries), effect of nuclear bursts on EM wave propagation (1 entry), aurora and EM wave propagation (7 entries), and over-the-horizon propagation studies (3 entries). The bibliography contains 85 entries. Other pertinent information included: experiments and measurements conducted by means of the Electron satellites, radio astronomy, ionospheric inhomogeneities, ionospheric currents and winds, solar radio emission, solar flares, atmospherics, magnetic storms, ionospheric backscatter. Author

N66-26228# Atomic Energy Commission, Washington, D. C. Fallout Studies Branch.
NATURAL ENVIRONMENTAL RADIOACTIVITY An Annotated Bibliography
Alfred W. Klement, Jr. Jul. 1965 143 p refs
(WASH-1061) CFSTI: HC $4.00/MF $1.00

Approximately 2000 annotated references are presented to literature on natural environmental radioactivity in the atmosphere, biological materials, soils, and waters. NSA

N66-26247*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
GEOMETRIC STRUCTURE OF THE EARTH'S GRAVITATIONAL FIELD AS DERIVED FROM ARTIFICIAL SATELLITES
W. Kohnlein 28 Jan. 1966 120 p refs
(Grant NsG-87-60)
(NASA-CR-75094; SAO Special Rept.-198) CFSTI: HC $4.00/MF $0.75 CSCL 08N

The structure of the Earth's gravitational potential and its gradient is studied at sea level and in outer space (1,000 km, 10,000 km, and 100,000 km elevation above sea level), with particular consideration given to the surfaces of constant potential and of constant gravitation. Their shape, curvature, etc., are computed and the results presented in tables and maps using the zonal part of the gravitational field as a reference frame. In a concluding section the geometry of the orthogonal trajectories of the equipotential surfaces (direction of the gradient field) is briefly touched. Author

N66-26349# American Meteorological Society, Boston, Mass.
THE STRUCTURE OF THE WIND-VELOCITY AND TEMPERATURE FIELDS IN THE ATMOSPHERIC SURFACE BOUNDARY LAYER [O STRUKTURE POLEI SKOROSTI VETRA I TEMPERATURY V PRIZEMNOM SLOE VOZDUKHA]
A. S. Monin Bedford, Mass., AFCRL, Dec. 1965 21 p refs Transl. into ENGLISH from Tr. Inst. Fiz. Atmos. (USSR), no. 4, 1962 p 5–20
(Contract AF 19(628)-3880)
(T-R-508; AD-628973) CFSTI: HC $2.00/MF $0.50

The term surface is used to designate the lowest layer of air, which is several tens of meters thick and in which the Coriolis force may be neglected. TAB

N66-26355# Utah Univ., Salt Lake City. Upper Air Research Lab.
ANTENNA IMPEDANCE PROBES IN HIGHLY DISTURBED IONOSPHERES Final Report, 1 Jun.–30 Sep. 1965
Karl G. Seljass Sep. 1965 47 p refs
(Contract AF 19(628)-5192)
(AFCRL-65-737; UU-66-2; AD-630591) CFSTI: HC $2.00/MF $0.50

This report details instrumentation developed for measurement of electron densities in a highly disturbed ionosphere. The measurement determines by a standing wave technique, the RF impedance of thin cylindrical antennas immersed in the plasma of the ionosphere. The electron density can be deduced from the antenna impedance variations. A previously developed Standing Wave Impedance Probe was used at frequencies of 3 and 12 MHz in conjunction with a newly developed 300-MHz system. Instrumentation details including schematic diagrams of both systems are presented. The dual impedance probe system was included in the payload of an Honest John-Nike-Javelin III fired from Eglin AFB in a DASA Project 6.4 certification round. Author (TAB)

N66-26369# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EVIDENCE OF IONOSPHERIC INHOMOGENEITIES OVER WALLOPS ISLAND
Irving Chidsey Aug. 1965 27 p refs
(BRL-MR-1700; AD-629922) CFSTI: HC $2.60/MF $0.50

Evidence of large-scale (20 percent variation, 150 km crest-to-crest) ionospheric inhomogeneity was discovered from analysis of two-frequency beacon data obtained during a daytime, high-altitude rocket flight at Wallops Island, Virginia, although similar flights 8 months earlier and 12 hours later provided inconclusive beacon data. Evidence of the inhomogeneity was also obtained from series of ionograms recorded concurrently with the first two flights, but not with the third. A digital ray tracing program was successfully used in reducing the data. Author (TAB)

N66-26370# Air Force Cambridge Research Labs., Bedford, Mass. Meteorology Lab.
MEAN DISTRIBUTION OF OZONE DENSITY OVER NORTH AMERICA, 1963–1964
Wayne S. Hering and Thomas R. Borden, Jr. Dec. 1965 28 p refs *Its* Environ. Res. Paper No. 162
(AFCRL-65-913; AD-629989) CFSTI: HC $2.00/MF $0.50

An interim summary of the ozone climate over North America has been prepared from AFCRL ozonesonde network observations made during 1963 and 1964 (AD-435 873, -604 880, -623 018). Mean bimonthly distributions of ozone density computed for individual network stations depict the average ozone structure as a function of altitude and season for the first two years of network operation. Data are also presented on the standard deviation of ozone density and the mean seasonal distributions along a meridional cross section extending from the Canal Zone to Greenland. A brief statistical analysis indicates that approximately 35 to 50 percent of the variance in the total ozone amount at middle and high latitudes is given by the fluctuations in ozone density in the 11- to 13-km or 13- to 15-km layers. Author (TAB)

N66-26375# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
THE DISTRIBUTION OF TEN-METER SNOW TEMPERATURES ON THE GREENLAND ICE SHEET
Steven J. Mock and Wilford F. Weeks Sep. 1965 50 p refs
(CRREL-RR-170; AD-624977) CFSTI: HC $4.60/MF $0.50

All available 10-m snow temperatures from the Greenland ice sheet have been collected and analyzed using multi-

ple regression techniques to develop equations capable of accurately predicting these temperatures. The resulting equations show that 10-m snow temperatures in north Greenland and its sub-areas can be accurately predicted from the independent parameters, latitude and elevation. Longitude was found to be another significant parameter in south Greenland. In all cases the values of the multiple correlation coefficients were .928 or greater. Gradients of 10-m snow temperature vs elevation for north Greenland are close to the dry adiabatic lapse rate, indicating adiabatic warming of katabatic winds as the controlling mechanism in the altitudinal distribution of both mean annual air temperatures and 10-m snow temperatures in dry snow. The data also suggest that south Greenland is colder with respect to its latitude and longitude than north Greenland. An isotherm contour map showing the distribution of 10-m snow temperatures on the Greenland ice sheet calculated from the prediction equations was prepared. A tabulation of the elevations and sources as well as brief studies of Marie Byrd Land and Victoria Land in the Antarctic are included. Author (TAB)

N66-26417# General Electric Co., Schenectady, N. Y. Research and Development Center.
APPLICATION OF ELECTRO-OPTICS TO AURORAL STUDIES, PHASE II Final Report, Nov. 1963–Nov. 1965
J. E. Anderson Dec. 1965 56 p refs
(Contract AF 19(628)-2366)
(AFCRL-66-75; AD-631048) CFSTI: HC $5.60/MF $0.50

During 1964–65 a continuing investigation was performed to examine the feasibility of obtaining information on the time-changing characteristics of the aurora and night air glow by low-light level image orthicons at the Radio-Optical Observatory of the General Electric Company's Research and Development Center in Schenectady, New York. Although no auroras were detected during this interim period, wavelength and intensity calibrations on a spectrograph of special design using the image orthicon detector were accomplished with spectral lamps and night air glow emissions. Included spectral photographs of night air glow demonstrate that the image orthicon is at least 1000 times faster than photographic film when detecting weak 'point' or 'line' sources under high contrast conditions. Twenty photoelectrons are sufficient to record a spectral line. Sensitivity calibrations were also performed on a 16 in. f/20 telescope, where the North Polar Sequence of Stars provided a standard calibrated star field. Within 10 seconds, 18th magnitude stars were detected. Further analysis is given on the data recorded during the September 1963 aurora and initially reported in the Final Report of Phase I, 1963–AFCRL 64-209. Author (TAB)

N66-26446# Sandia Corp., Albuquerque, N. Mex.
GROUND DEPOSITION OF MICROSPHERES RELEASED FROM 50 KILOMETERS
D. F. Warnke Jan. 1966 28 p refs
(Contract AT(29-1)-789)
(SC-TM-65-398) CFSTI: HC $2.00/MF $0.50

The surface deposit densities which result from a distribution of microspheres being released at an altitude of 50 kilometers and dispersed by gravitation, wind, and diffusion were calculated and are presented for eight wind conditions. The results proved to be useful as a rough guide to the sensitivity of deposit densities to particle size distribution parameters, source altitude, vertical wind shear, and lateral dispersion rates as well as an aid in investigating the merits of any refinements to the TRC model. Author (NSA)

N66-26476# Junta de Energia Nuclear, Madrid (Spain). Seccion de Investigacion Geologica.
CONSIDERATIONS ON THE GENESIS OF URANIFEROUS DEPOSITS. II: SOME PROBLEMS OF THE THERMODYNAMIC STATE OF METALLOGENIC SYSTEMS [CONSIDERACIONES SOBRE LA GENESIS DE LOS YACIMIENTOS URANIFEROS. II: ALGUNOS PROBLEMAS DEL ESTADO TERMODINAMICO DE LOS SISTEMAS METALOGENICOS]
E. Mingarro 1965 29 p refs In SPANISH Submitted for Publication
(JEN-155-SIG/1-4)

In order to get a classification of the uranium deposits, the geological processes were ordered in thermodynamic systems according to the independent parameters that define their equilibrium state. Also, to apply the phase rule, it is assumed that the ore forming elements are always ideally mobile components; that is, in the geological systems, these components are defined by their chemical potentials. It is shown that in random conditions, i.e., for any possible value of the factors of equilibrium or state, the stable mineralizations are formed only in metasomatic regimes; so that the mineralogical sequence is a function both of the Helmholtz's free energy and the crystallization pressure of the minerals. Author (NSA)

N66-26499# Emmanuel Coll., Boston, Mass. Research Language Center.
A PRELIMINARY STUDY OF THE FORMATION OF PRESSURE JUMPS BY A SMALL MOUNTAIN IN A TWO-LAYER MODEL
Jih-Ping Chao, Kung-Kuan Chang, and Shiao-Ming Yan Bedford, Mass., AFCRL, Feb. 1966 20 p refs Transl. into ENGLISH from Acta. Met. Sinica, (Peking), v. 34, no. 2, 1964 p 233–241
(Contract AF 19(628)-5073)
(EMM-65-37; AD-631117) CFSTI: HC $1.00/MF $0.50

In this paper the influence of a small mountain on the airflow above is examined by means of a two-layer model. The one-dimensional solution for the steady state reveals that the degree of perturbation in the airflow in a mountainous region is determined by the upstream conditions as well as the height of the mountain. Provided that the height of the mountain reaches a critical value, a stationary pressure jump will occur on the lee side when the Froude number of the upwind side is less than 1. The occurrence of the pressure jump is then examined by means of a one-dimensional solution for the unsteady state. Author (TAB)

N66-26513# Naval Research Lab., Washington, D. C.
ATMOSPHERIC RADIOACTIVITY IN ANTARCTICA, 1956-1963
L. B. Lockhart, Jr., R. L. Patterson, Jr., and A. W. Saunders, Jr. 3 Nov. 1965 21 p refs
(NRL-6341; AD-625439) CFSTI: HC $1.00/MF $0.50

Continuous measurements of the radioactive aerosol content of the surface air in Antarctica have been made since 1956, first at Little America and later at the Amundsen-Scott South Pole Station. Both the radioactivity due to bomb-produced fission products and to the naturally occurring radionuclides of the radon and thoron series were measured in daily collections; composite samples covering three-month periods were subjected to radiochemical analysis for such long-lived radionuclides as Sr^{90}, Cs^{137}, Ce^{144}, Pm^{147}, and Pb^{210}. The observed natural radioactivity was lower in Antarctica than at any other geographical location, as might be expected from the absence of any quantity of exposed land surface in the vicinity. The fission-product concentrations, however, were equal to or greater than those ob-

served in the southernmost parts of South America. Well-defined seasonal variations in airborne radioactivity were noted, with maxima in the summer. Author (TAB)

N66-26515# Institut for Defense Analyses, Arlington, Va. Research and Engineering Support Div.
EXPLORATORY MEETING ON THE MAGNETIC TAPE RECORDING OF SEISMIC DATA
Joseph M. Aein Sep. 1965 27 p refs
(Contract ARPA SD-50)
(P-210; AD-625199) CFSTI: HC $2.00/MF $0.50

The problems of obtaining magnetic tape records of seismic data over a relatively wide bandwidth (up to 10 cps) with large dynamic range are reviewed, and current seismic tape recording capabilities are surveyed. TAB

N66-26540# Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF EQUATION OF STATE OF POROUS EARTH MEDIA Final Report, 15 Jun. 1964–28 Jul. 1965
G. D. Anderson, G. E. DuVall, J. O. Erkman, G. R. Fowles, and C. P. Peltzer Kirtland AFB, N. Mex., AF Weapons Lab., Feb. 1966 177 p refs
(Contract AF 29(601)-6427)
(AFWL-TR-65-146; AD-628803) CFSTI: HC $5.00/MF $1.00

Earlier experimental work has been extended to evaluate the effect of moisture on the Hugoniot of playa. For engineering applications the Hugoniot of moist playa can be predicted with sufficient accuracy from the Hugoniot of dry playa and water and the assumption of pressure equilibrium. Isentropic release data were obtained for moist and dry playa. The steep release curve (in the P-V plane) from high pressure implies an irreversible phase change. Some low pressure data in the elastic-plastic region are presented. A theoretical discussion of various forms of the Mie-Gruneisen equation and the physical basis of asymptotic statistical models is presented. Shock stability is reviewed. Phase transitions in which $\delta V<0$ are classified according to the signs of the slopes of the coexistence curves. Relative slopes of Hugoniots and isentropes in the mixed phase region are calculated. The results of the theoretical discussion are applied to transitions in bismuth, iron, and quartz. Agreement of values of dP/dT deduced from shock data and measured directly are good for bismuth and poor for quartz and iron. Calculations of spherical shock propagation in a hypothetical medium that undergoes a phase change are presented. The calculations show qualitatively some types of pulse shapes that may be expected in a transforming medium. It is concluded that the proper treatment of phase changes is an outstanding problem in predicting equations of state for earth materials. Author (TAB)

N66-26541# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
COLD REGIONS SCIENCE AND ENGINEERING. PART I: ENVIRONMENT. SECTION A: GENERAL. SELECTED ASPECTS OF GEOLOGY AND PHYSIOGRAPHY OF THE COLD REGIONS
S. Russell Stearns Jul. 1965 52 p refs
(I-A1; AD-630983) CFSTI: HC $3.00/MF $0.75

The purpose of this work is to provide those contemplating scientific or engineering activities in cold regions with a general picture of their geology and physiography. The cold regions are the Arctic, Alaska, Canadian Arctic and subarctic, Greenland, Iceland, Jan Mayen Svalbard, Scandinavia, U.S.S.R., and the Antarctica. TAB

N66-26545# Emmanuel Coll., Boston, Mass. Research Language Center.
INFLUENCE OF SOLAR ROTATION ON THE GEOMAGNETIC FIELD (II)
Yueh-Jen Hu Bedford, Mass., AFCRL, Sep. 1965 17 p refs Transl. into ENGLISH from Ti Ch'iu Wu Li Hsueh Pao (Peking), v. 8, no. 2, 1959 p 123–131
(Contract AF 19(628)-5073)
(Emm-65-7; TT-66-61024; AD-631120) CFSTI: HC $1.00/MF $0.50

The following problems are studied: (1) The frequency distribution of magnetic storms: large as well as moderate magnetic storms occur more frequently on some days during the period of solar rotation than others. (2) The periodic variation of the daily K index total during the period of solar rotation: the K index is a comparatively more objective standard for indicating geomagnetic activity. Curves showing its variation are primarily consistent with the frequency distribution curves of international magnetically disturbed days. (3) The periodic variation of the daily average of the geomagnetic field's horizontal intensity during the period of solar rotation: similar to the case of the K index, the effect of solar rotation on the horizontal intensity is also very pronounced. The crest occurs within the period of solar rotation when there are fewer disturbed days and the trough occurs when there are more disturbed days. The time lag is approximately one day in both cases. Author (TAB)

N66-26586# Utah Univ., Salt Lake City. Upper Air Research Labs.
DETERMINATION OF THE ELECTRON DENSITY IN THE IONOSPHERE BY THE PULSE DELAY TECHNIQUE Final Scientific Report, 2 Feb. 1962–31 Mar. 1965
Kay D. Baker and Glenn D. Allred Mar. 1966 132 p refs
(Contract AF 19(628)-352)
(UU-66-1; AFCRL-66-55; AD-630126) CFSTI: HC $13.60/MF $1.00

Rocketborne pulse-delay and pulse-phase experiments were developed to measure integrated free electron density between a rocket operating in the ionosphere and stations on the earth's surface. Electron density is related to the group delay and phase velocity of transmitted signals, and is attained by measuring these parameters. The transit time and phase velocity of probing signals near the critical frequency of the layer of ionosphere under investigation, are compared with those of a reference signal which suffers negligible effects during transit. Three rockets were instrumented with upward transmission pulse delay experiments and launched, and a fourth, instrumented with a downward pulse-phase delay experiment, was brought to a state of near readiness. A miniature, rocketborne system has resulted which is capable of yielding parameters related to electron density. While of limited value in a highly disturbed ionosphere, the experiment is a valuable source of data in an undisturbed medium. Author (TAB)

N66-26581# Emmanuel Coll., Boston, Mass. Oriental Science Library.
INFLUENCE OF SOLAR ROTATION ON THE GEOMAGNETIC FIELD (I)
Yueh-Jen Hu Bedford, Mass., AFCRL, Sep. 1965 11 p refs Transl. into ENGLISH from Ti Ch'iu Wu Li Hsueh Pao (Peking), v. 7, no. 2, 1958 p 103–107
(Contract AF 19(628)-5073)
(EMM-65-6; AD-631062) CFSTI: HC $1.00/MF $0.50

International geomagnetically disturbed days are found to have an invariable frequency distribution during the period of solar rotation. Geomagnetic disturbances on high-frequency

days are approximately twice as great as on low-frequency days; and solar activity is unevenly distributed in the longitudinal circles of the Sun. These preliminary conclusions are based on an analysis of geomagnetic data for the period from 1923 through 1954. Five international magnetically disturbed days were used in the study of the frequency distribution during the period of solar rotation. M.W.R.

N66-26803# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A REVIEW OF LONG-RANGE EARTH STRAIN MEASUREMENT TECHNIQUES FOR PROVIDING EARTHQUAKE WARNING
Ernst Gehrels 13 Dec. 1965 23 p refs *Its* Tech. Note 1965-62
(Contract AF 19(628)-5167; ARPA Order 512
(ESD-TDR-65-564; AD-625817) CFSTI: HC $1.00/MF $0.50

One of the most valuable tools for studying earthquakes and faults is earth strain or displacement measurements. Geologists are now looking for minute telltale displacements that might occur before an earthquake. This report discusses the possible accuracies that might be achieved by three different electromagnetic measurement techniques: (1) Microwave phase measurements, (2) Modulated light beams, and (3) Laser interferometers. The first is extremely sensitive to propagation errors. The second can achieve a modest degree of accuracy, 10^{-7} or better, and will clearly meet the minimum requirements. The third will provide by far the greatest degree of accuracy for propagation path lengths over which at least a partial degree of coherence of the wave front can be maintained. Author (TAB)

N66-26850*# Stanford Univ., Calif. Radioscience Lab.
INTERPRETATION OF IMPEDANCE PROBE MEASUREMENTS IN THE IONOSPHERE Technical Report No. 2
R. J. L. Grard Dec. 1965 103 p
(Grant NsG-174-61)
(NASA-CR-75122; SEL-65-102) CFSTI: HC $4.00/MF $0.75 CSCL 04A

Measurements of the very low frequency impedance of the sheath which surrounds a probe in the ionosphere can provide instantaneous and continuous information on the electron density and temperature. A simplified theory of the sheath was developed and its validity was checked in the laboratory. Variations of the sheath impedance with frequency, electron density and probe potential are presented. The ac impedance of a dipole was measured in the ionosphere. The interpretation of the data is complicated by the effect of the earth's magnetic field and the wake of the rocket, but the theoretical treatment is shown to apply with reasonable accuracy at low frequency. We conclude with a discussion of the utility of impedance measurements in the ionosphere as a diagnostic technique. Author

N66-26887*# Arizona State Univ., Tempe. Center for Meteorite Studies.
METEORITIC RUTILE
Peter B. Buseck and Klaus Keil (NASA, Ames Res. Center) Apr. 1966 22 p refs Submitted for Publication
(Contract NsG-399)
(NASA-CR-75182) CFSTI: HC $1.00/MF $0.50 CSCL 08D

Rutile has not been widely recognized as a meteorite constituent. Recent microscopic and electron microprobe studies show, however, that TiO_2 is a reasonably widespread phase, albeit in minor amounts. X-ray diffraction studies confirm the TiO_2 to be rutile. It was observed in the following meteorites—Allegan, Bondoc, Estherville, Farmington, and Vaca Muerta. The rutile is associated primarily with ilmenite and chromite, in some cases as exsolution lamellae. Author

N66-26728# National Physical Lab., New Delhi (India). Radio Propagation Unit.
IONOSPHERIC DATA
Jun. 1964 76 p
(RRC-A109) CFSTI: HC $3.00/MF $0.75

The coordinated ionospheric data of all the Indian stations for June 1964, supplemented with pertinent geophysical data, are presented. The data recorded includes: ordinary wave critical frequency; ordinary wave top frequency; minimum virtual height on ordinary wave branch; and lowest virtual height of the trace. Data on the E, F1 and F2 layers are given. N.E.N.

N66-26824# Geophysics Corp. of America, Bedford, Mass. Technology Div.
SODIUM VAPOR EXPERIMENT Quarterly Progress Report No. 3, 1 Jan.–31 Mar. 1966
Apr. 1966 31 p refs
(Contract NAS5-3970)
(NASA-CR-75255) CFSTI: HC $2.00/MF $0.50 CSCL 04A

Results of a January 1966 series of rocket soundings for investigating the dynamics of the upper atmosphere through analysis of the motion of ejected sodium vapor trails are presented and discussed. Data were taken photographically from several widely separated sites. Triangulation was used to determine winds from the rate of motion of the trail, and densitometry measurements determined the growth rate and small-scale structure of the trail. Among the conclusions are that the build up or collapse of the large-scale spiral patterns require at least six hours. This time as well as the rate of downward motion of the profile is characteristic of large-scale tidal oscillations. The presistence of a wind speed of 100 m/sec for a three hour period suggests a horizontal scale of over 1000 km. C.T.C.

N66-26852*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
SOME RESULTS CONCERNING THE PRINCIPAL AIRGLOW LINES AS MEASURED FROM THE OGO-II SATELLITE
Edith I. Reed and Jacques E. Blamont (Centre Natl. de la Rech. Sci., Paris) Apr. 1966 33 p refs
(NASA-TM-X-55488; X-613-66-190) CFSTI: HC $2.00/MF $0.50 CSCL 04A

Two photometers on the OGO-II spacecraft (launched October 14, 1965, 420 km perigee, 1520 km apogee, 87.4° inclination) scanned the airglow horizon through a filter centered at 6300A, the nadir airglow at 6300A, 6225A, 5890A, 5577A, 3914A, and 2630A, and the zenith airglow at 6300A. During its less than 10 days of stabilized operation approximately an hour of data were obtained while in the earth's shadow. The nadir measurements observed the blue enhancement at twilight, several aurorae, and typical nighttime airglow. The horizon scanning photometer observed the two airglow layers, a thick one generally above 200 km attributed to the 6300A line of atomic oxygen and a thin layer centered between 75 and 105 km atrributed to the OH emissions which fall within the 40A wide passband of the interference filter. The maximum emission of the 6300A line occurred generally between 200 and 300 km altitude with values of 1 to 25 photons cm^{-3} sec^{-1} at night and about a factor of 10 greater in the twilight. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N66-25389# Central Lab. for Radiological Protection, Warsaw (Poland).
ALPHA CONTAMINATION LOCATOR WITH JUNCTION RADIATION DETECTOR [PRZYRZAD Z POLPRZEWODNIKOWYM DETEKTOREM PROMIENIOWANIA DO LOKALIZACJI SKAZEN ALFA]
B. Bukowiecki 1965 12 p refs
(CLOR-39/D) CFSTI: HC $1.00/MF $0.50

An alpha contamination locator with a semiconductor radiation detector has been designed as a small, portable instrument which provides a precise location of alpha contamination. Electronic circuits provide an audible acoustic signal for every alpha particle that loses, within detector sensitive volume, at least 600 keV of its energy. The instrument works with or without an extension of about 50 cm, according to the conditions of the measurements actually performed. Author

N66-25397# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Berlin (West Germany). Institut für Turbulenzforschung.
ON SOME SPECIAL PROBLEMS OF HOT-WIRE TECHNIQUE [UBER EINIGE SPEZIELLE PROBLEME DER HITZDRAHTMESSTECHNIK]
Peter Freymuth Jan. 1966 42 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-03; DVL-484) CFSTI: HC $2.00/MF $0.50

The sine- and square-wave tests for CT-anemometers were calculated and compared with observed tests. A comparison of the signal-to-noise ratio of CT- and CC-anemometers showed equivalence, a result which deviates from the results of other authors. Experiences with an adaptive CT-control system, an anemometer with digital output, and the constant voltage method are considered. The application of a negative resistance for CT-anemometers is described. A test method is described for optimizing and checking the linearity of linearization stages in CT-anemometers for accuracy. Author

N66-25434# Royal Greenwich Observatory, Herstmonceaux (England).
PIVOT ERRORS AND AXIS FLEXURE IN THE 7-INCH COOKE TRANSIT CIRCLE
R. d'E. Atkinson, L. S. T. Symms, and K. C. Blackwell London, HMSO, 1966 24 p refs *Its* Royal Obs. Bull. No. 109
HMSO: 3s

The pivot testing apparatus of the Cooke transit circle was replaced by an autocollimation arrangement which proved repeatable and precise, but which responds to flexure of the E-W axis and to pivot errors. The two effects are separable if the flexure can be assumed to be symmetrically distributed along the axis, and the pivot errors so determined were adopted for use. Measurements were made, varying the conditions, and the consistency was good. In particular, there was no obvious dependence on the rotation direction. The Fourier coefficients of both pivot errors and flexure are tabulated and the adopted pivot errors are shown graphically. The principal flexure term was larger than any pivot coefficients, and the flexure also showed higher harmonics than the second, including odd harmonics. The effect of changing the pivot loading was investigated, and also the effects of partially and totally removing the telescope, without change of pivot loading. Large and unexpected changes in the flexure were found. The axis flexure will not affect the astronomical results if there is the E-W symmetry which was assumed in deriving it, but if not, the deduced pivot errors will be wrong and the flexure will tilt the telescope out of the meridian. R.N.A.

N66-25475# European Atomic Energy Community, Brussels (Belgium).
CRYOSTAT IN THE GASEOUS PHASE [UN CRYOSTAT EN PHASE GAZEUSE]
R. Debeir and M. Grin Feb. 1966 16 p In FRENCH; ENGLISH summary
(EUR-2710.f) CFSTI: HC $1.00/MF $0.50

A cryostat working with the gaseous phase is described; the thermostatic fluid is nitrogen which is vaporized in the measuring chamber. The apparatus is characterized by a very manageable operation and can be used at every temperature between room temperature (20°C) and the temperature of liquid nitrogen (−196°) and can be adapted to various physical measurements (resistivity, tension tests at low temperature). Author

N66-25532*# Advanced Kinetics, Inc., Costa Mesa, Calif.
NEW CONCEPTS FOR HIGH ENERGY RATE FORMING SYSTEM Summary Report
R. W. Waniek et al 27 Aug. 1965 108 p refs
(Contract NAS8-11758)
(NASA-CR-74918) CFSTI: HC $4.00/MF $0.75 CSCL 14B

High pressure waves created by a plane magnetically actuated diaphragm are investigated both theoretically and experimentally for use in a high energy rate forming system. Transducer technology has been employed in a qualitative and quantitative investigation of the pressure pulse phenomenon in a liquid medium; and an optimized magnetohydraulic forming system has been designed. Experimental studies utilizing various modes of operation have been made with regard to both pressure and deformation studies; and optimization of the pressure pulse has been carried out. An inductive storage device has been designed, constructed, and optimized for switching efficiency. M.W.R.

N66-25561*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TECHNIQUES FOR THE DESIGN, EVALUATION, AND ANALYSIS OF ENDLESS-LOOP TAPE TRANSPORTS FOR SATELLITE APPLICATIONS
Kenneth W. Stark (M.S. Thesis—Catholic Univ.) Washington, NASA, May 1966 46 p
(NASA-TN-D-3391) CFSTI: HC $2.00/MF $0.50 CSCL 14C

The design criteria and analysis of components and characteristics of a 1200 foot endless-loop tape recorder are presented. Component and characteristics analysis was made of the capstans, the preloaded bearings, the ball bearing effects on tape velocity, tape performance, and system resonance and inertial characteristics. Graphed and tabulated data are included for tape speed and tension levels. Performance evaluation was obtained by flutter and wow measurements, the power required to operate the system, and an amplitude modulation trace analysis. The endless-loop cartridge operation is mentioned. N.E.N.

N66-25577*# LTV Aerospace Corp., Dallas, Tex. Research Center.
LTV BETA-GAMMA SPECTROMETER, MODEL BG-1 Final Report
N. E. Chappell and B. J. Farmer Aug. 1965 41 p *Its* Rept.-0-71000/5R-23
(Contract NAS9-4013)
(NASA-CR-65354) CFSTI: HC $2.00/MF $0.50 CSCL 20F

A beta–gamma spectrometer in space prototype configuration was built to measure simultaneously the spectra of electrons and bremsstrahlung, at the same time eliminating background cosmic radiation. These functions are accomplished through the use of a complex scintillation crystal assembly composed of two phosphors with different phosphorescent decay times. It is noted that, since the radiation received by an astronaut may result from either bremsstrahlung or direct electron penetration through the spacecraft walls, such a device offers several advantages over a combination of devices necessary to perform the same function in space. It is further noted that this concept has also proven useful in laboratory measurements of electrons scattered by foils, where bremsstrahlung would normally produce exceptionally high backgrounds. The output of the apparatus is in two separate channels of linear pulse height information compatible with a multichannel pulse height analyzer. In conjunction with an appropriate selective storage unit, both beta and gamma spectra may be stored in separate sections of the analyzer memory. D.T.

N66-25579# Arizona Univ., Tucson. Steward Observatory.
8-INCH ULTRAVIOLET CAMERA FOR APOLLO Final Technical Report
W. G. Tifft and A. B. Meinel 1 Apr. 1966 122 p
(Contract NAS9-5193)
(NASA-CR-65360; A66-02) CFSTI: HC $4.00/MF $1.00 CSCL 14E

The scientific desirability and technical feasibility of a small stabilized wide-field astronomical camera system with recoverable film were investigated for Apollo earth orbital missions. The proposed system is to utilize relatively unsophisticated state-of-the-art techniques and components in order to permit rapid and reliable development. Future applications of the system are divided into two areas, i.e., the use of the stabilized platform with any small experiment package, and the use of the camera system or its derivatives for astronomical observations. The scientific, optical, and engineering programs are described in detail; and the system performance specifications are presented. D.T.

N66-25590# India. Dept. of Atomic Energy, Bombay. Radiochemistry and Isotope Div.
TOTAL COUNT METHOD FOR OPEN CHANNEL FLOW MEASUREMENT
A. C. Eapen and S. M. Rao 1964 25 p refs
(AEET/Radiochem/65) CFSTI: HC $1.00/MF $0.50

This report describes a radioactive isotope method for solving flow measurement problems. The technique, termed the total count method, is simple in application and more accurate than the velocity or dilution techniques, which also use radioactive isotopes. In this method, a known quantity of the selected gamma emitting radioisotope is mixed with the stream and a detector placed at a distance downstream registers the total count as the tracer patch passes it. The total count N and the amount of activity A bears a simple relation with the fluid flow rate Q given by Q=AF/N where F is a calibration factor characteristic of the isotope, the counter, and the geometry of measurement. This can be determined in the laboratory by performing the experiments under the same geometrical conditions. If the stream is very wide, the tank used for determining F should be large enough so that there is no contribution to the counter from the tank wall vicinity and also taking into consideration the Compton buildup. The results of several experiments using the total count method are included. R.N.A.

N66-25600# Institut Franco-Allemand de Recherches, St. Louis (France).
THE RESOLVING POWER OF MAGNETIC MASS SPECTROMETERS WITH SPECIAL REGARD TO THOSE SPECTROMETERS USED AT ISL [DAS AUFLOSUNGSVERMOGEN MAGNETISCHER MASSENSPEKTROMETER UNTER BESONDERER BERUCKSICHTIGUNG DER IM ISL VERWENDETEN SPEKTROMETER]
15 Jul. 1964 27 p ref In GERMAN
(ISL-T-20/64) CFSTI: HC $2.00/MF $0.50

The terms dispersion coefficient, mass dispersion, energy dispersion, width of image, and experimental and theoretical resolving power were defined and stated. Relation of resolving power and sensitivity was examined. A universally applicable formula for maximum sensitivity of the intake opening and aperture diaphragm is stated and then applied to two types of spectrometers. The resolving power of the institute's spectrometer was calculated by means of an N_2, O_2 spectrum; the resolving power 57 resulted. K.W.

N66-25635# International Training Centre for Aerial Survey, Delft (Netherlands).
ON THE ACCURACY OF AEROTRIANGULATION WITH CONVERGENT PHOTOGRAPHY
I. Hadem 1965 45 p refs *Its* Ser. A, No. 34
CFSTI: HC $2.00/MF $0.50

The use of aerial triangulation in convergent photography is discussed; and the influences of inner orientation errors on single models are compared with influences of observational errors in parallaxes and coordinates, some general considerations concerning propagation of errors in aerotriangulation are reviewed, and numerical examples of various errors are presented. A comparison is made between two types of convergent photography and wide angle vertical photography. It is concluded that the smallest closing errors occur in wide angle convergent photography, but there is no clear difference between normal angle convergent and wide angle vertical photography. M.W.R.

N66-25642# International Training Centre for Aerial Survey, Delft (Netherlands).
DYNAMIC PERFORMANCE OF PHOTOGRAMMETRIC PLOTTING INSTRUMENTS
B. Macarovic 1965 72 p refs *Its* Ser. A, No. 35
CFSTI: HC $3.00/MF $0.75

Criteria for the efficiency and capabilities of photogrammetric plotting systems are defined, and disturbances in the dynamic process are separated and located. In order to evaluate the dynamic performance of these stereoplotters to reproduce compositions of line elements with arbitrary curvatures, an analysis is made of differences between input and output signal flow. Efficiency is considered in terms of speed function, noise or transfer function, and a combination of the two. Following a description of the general approach proposed for making the evaluation, discussions are included of the standard input, execution of the test, distortions, reliability, capability, and representations of disturbances. Results obtained during testing the dynamic performance of a large-scale plotter are appended. M.W.R.

N66-25651# European Organization for Nuclear Research, Geneva (Switzerland).
A GENERAL SYSTEM ON NUMERICAL MEASUREMENT ADAPTED FOR C.P.S. [UN SYSTEME GENERAL DE MESURE NUMERIQUE ADAPTE AU C.P.S.]
O. Barbalet and F. Ollenhauer 7 Feb. 1966 76 p refs In FRENCH; ENGLISH summary
(CERN-66-5)

A digital measurement system, whose elements are separate modular units, is described. Its operation is based on the transformation of the signal to be measured into a time interval or a frequency which is digitized by an electronic counter. It is pointed out that the design takes into account the special conditions of a large particle accelerator, especially the conditions of data transmission. D.T.

N66-25656# Institut Franco-Allemand de Recherches, St. Louis (France).
DIFFERENTIAL INTERFEROMETER FOR OBSERVING AND MEASURING BOUNDARY LAYERS [DIFFERENTIALINTERFEROMETER ZUR BEOBACHTUNG UND AUSMESSUNG VON GRENZSCHICHTEN]
G. Smeets 2 Sep. 1964 46 p In GERMAN
(ISL-T-25/64 CFSTI: HC $2.00/MF $0.50

Beam direction and characteristics of a general, not necessarily symmetrical, differential interferometer with Wollaston prisms are calculated. The form of the interference bands corresponding with a one-dimensional change of the refraction index in the measuring chamber is worked out into an equation. A possibility for obtaining a greater number of interference bands by means of white light is demonstrated. Adjustment of the interferometer for best observation of compressible boundary layers is discussed. Transl. by K.W.

N66-25664# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
SLIDE-RULE FOR DETERMINATION OF THE FREQUENCY OF NUCLEAR MAGNETIC RESONANCE [SUWAK DO OKRESLANIA CZESTOTLIWOSCI MAGNETYCZNEGO REZONANSU JADROWEGO]
J. Chmielewski Apr. 1965 9 p In POLISH; ENGLISH summary
(Rept.-618/XV/I) CFSTI: HC $1.00/MF $0.50

A simple slide-rule is described which gives instant indication of nuclear magnetic resonance frequency for several isotopes placed in definite magnetic field. A slide-rule consists of two logarithmic scales which can be aligned depending on chosen isotope. Author

N66-25683# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TEMPERATURE SENSING SYSTEM FOR MANOMETRIC THERMOMETERS
Z. G. Blyumshteyn, V. S. Cherepanov, E. Z. Miftakhov, A. G. Spasskiy, B. A. Fomin et al 17 Feb. 1966 4 p Transl. into ENGLISH from the Russian patent no. 166520 (Appl. no. 875764/26-10, 13 Jan. 1964) 1 p
(FTD-TT-65-1934; AD-630265) CFSTI: HC $1.00/MF $0.50

A temperature sensing system for manometric thermometers containing a thermal bulb and a capillary is described. To extend the upper limit of temperature measurement to 1200°C an alloy containing 66.8 to 67.2% gallium, 10.3 to 10.7% indium, and 12 to 13% tin is used as a filler. The thermal bulb is made of a material that is stable to the filler at high temperatures, for example, alundum or some other ceramic or ceramet material. TAB

N66-25684# David Taylor Model Basin, Washington, D. C.
THE DTMB MARK 1 MOD 1 KNOTMETER
George B. Springston, Jr. Mar. 1966 11 p refs
(DTMB-1944, Suppl.; AD-630319) CFSTI: HC $1.00/MF $0.50

The David Taylor Model Basin Mark 1 Mod 1 Knotmeter is a modification to the previously developed Mark 1 Knotmeter and consists of a substitution of transistorized instrumentation for vacuum-tube instrumentation. This change tends to improve the reliability of the system but does not alter its calibration. Author (TAB)

N66-25796# Institut Franco-Allemand de Recherches, St. Louis (France).
REMARKS ON THE DOPPLER RADAR MEASURING METHOD FOR INTERIOR BALLISTICS MEASUREMENTS [BEMERKUNGEN ZUR DOPPLERRADAR-MESSMETHODE FUR INNENBALLISTISCHE MESSUNGEN]
G. Schultze 3 Dec. 1964 28 p In GERMAN
(Contract T-451-J-206)
(ISL-T-40/64) CFSTI: HC $2.00/MF $0.50

Circuits, methods, and results of the Doppler radar arrangement for measuring interior ballistics are given. An amplifier developed for registering the Doppler shift permits precise evaluation through conversion of sine oscillations into sharply defined impulses, and also interpolation through time-and-location-dependent registration signals. Transl. by K.W.

N66-25798# Institut Franco-Allemand de Recherches, St. Louis (France).
CALCULATION OF THE RESOLUTION OF A CAMERA FOR MOVING OBJECTS [CALCUL DE LA RESOLUTION D'UNE CAMERA POUR MOBILES EN MOUVEMENT]
H. Paques 25 Feb. 1965 39 p refs In FRENCH
(ISL-T-4/65) CFSTI: HC $2.00/MF $0.50

Evidence is given for the existence of an optimal resolution for the photographing of a body in motion. This resolution is restored to the object space, since it is ultimately the object in motion for which the most possible detail is sought. The resolution depends on the following: velocity of the moving body; luminosity of the entire event, and the sensitivity of the film; the grain of the film; and the depth of the event. The optimum resolution is achieved by the mutual adjustment of the aperture and the magnification. Transl. by D.T.

N66-25802# Institut Franco-Allemand de Recherches, St. Louis (France).
HOLOGRAPHY [HOLOGRAPHIE]
H. Paques and P. Smigielski 4 Jan. 1965 47 p refs In FRENCH
(ISL-T-1/65) CFSTI: HC $2.00/MF $0.50

A number of experimentally verified properties of holography were theoretically deduced from the Kirchhoff-Fresnel integral. Some supplementary hypotheses were also deduced. Among these was the possibility of the holography of a body in motion, the reconstituted image not being altered except for the blur from the movement during the time of exposure. D.T.

N66-25856# ARO, Inc., Arnold Air Force Station, Tenn.
INVESTIGATION OF MICROWAVE AND SONIC METHODS FOR MEASURING LIQUID LEVEL AND FLOW RATE
K. R. Carr and J. U. Clark Arnold Eng. Develop. Center, Mar. 1966 32 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-1; AD-630315) CFSTI: HC $2.00/MF $0.50

Microwave and ultrasonic reflections from a liquid surface have been studied to determine the feasibility of their

use in measuring liquid flow. Reflected ultrasonic pulses appear useful for measuring the change between static levels of large dimensions. However, for measuring small continuous changes the accuracy is not satisfactory. Microwave reflections provide an output that can be used for the measurement of total change in level or flow data. Author (TAB)

N66-25938# Army Engineer Research and Development Labs., Fort Belvoir, Va.
TESTING OF DRIVELESS HUBODOMETERS Interim Report, Nov. 1964–Oct. 1965
Robert C. Watson Jan. 1966 13 p
(Rept.-1846; AD-630435) CFSTI: HC $1.60/MF $0.50

The report covers the testing of three samples of revolution counters designated as Driveless Hubodometers. All three samples of the revolution counters were installed and tested on a Caterpillar Model 12E motor grader. The results of the endurance test indicate that the revolution counters would perform satisfactorily when installed on pneumatic-tire type of equipment. The results of the accuracy tests indicate that the revolution counters would be of limited benefit when installed on equipment traveling relatively short distances. On equipment traveling long distances (500 to 1,000 miles), the counters would have a high degree of accuracy and would prove to be beneficial. Author (TAB)

N66-25968# Aktiebolaget Atomenergi, Stockholm (Sweden).
A SCINTILLOMETER ASSEMBLY FOR GEOLOGICAL SURVEY
E. Dissing and O. Landstroem Dec. 1965 16 p refs
(AE-203)

An instrument for gamma radiation measurements in connection with geological survey is described. It consists of a scintillation detector with a 5 in. dia × 6 in. sodium iodide crystal and a pulse height analyzer with four independent channels. In field survey work these channels are usually set in fixed positions to record different components of the gamma radiation simultaneously in order to facilitate an identification of the radioactive mineral from which the radiation originates. However, the instrument can also be used for more detailed study of gamma spectra either in the field or in the laboratory. The methods for interpretation of gamma spectra from radioactive ores are briefly reviewed, and a few typical results are given from car-borne and air-borne survey. Author (NSA)

N66-25971# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.
RESOLUTION OBTAINABLE WITH SOME TRC'S WITH ELECTROSTATIC DEFLECTION AND THEIR UTILIZATION IN A DEVICE FOR SCANNING PHOTOGRAMS OF MONOGAP SCINTILLATION CHAMBERS [RISOLUZIONI RAGGIUNGIBILI CON ALCUNI TRC A DEFLESSIONE ELETTROSTATICA E LORO UTILIZZAZIONE IN UN DISPOSITIVO DI LETURA DI FOTOGRAMMI DI CAMERE A SCINTILLA MONOGAP]
M. Avaltroni and F. Pandarese 25 Sep. 1965 20 p refs In ITALIAN *Its* Nota Interna No. 290
(LNF-65/33)

The preliminary work on the design and construction of some parts of a device for the automatic analysis of spark chamber photographs is reported. The resolution obtainable with a given type of cathode-ray tube is investigated with a quantitative determination of the effect of some factors such as contrast of the photograph and granularity of the phosphor of the cathode-ray tube. A simple device for the analysis of monogap chamber photographs is also described. NSA

N66-26002# Princeton Univ., N. J. Plasma Physics Lab.
A FERROMAGNETIC RESONANCE MAGNETOMETER
W. P. Ernst and A. H. Skislak Sep. 1965 20 p refs
(Contract AT(30-1)-1238)
(MATT-362) CFSTI: HC $1.00/MF $0.50

A ferromagnetic magnetometer system is described that is capable of measuring transient magnetic field values with the accuracy of 1 part in 10^4. The use of stoichiometric yttrium iron garnet material enables one to perform point field measurements where large gradients are present. NSA

N66-26007# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
APPLICATION OF ELECTROPHOTOGRAPHY FOR MEASUREMENTS OF SENSITIVE REGION OF GERMANIUM P–I–N DETECTORS [PRIMENENIE ELEKTROFOTOGRAFII DLYA IZMERENIYA CHUVSTVITEL'NOI OBLASTI GERMANIEVYKH P–I–N–DETEKTOROV]
A. S. Antonov and L. G. Yuskeselieva 1965 10 p refs In RUSSIAN
(JINR-P-2487)

The width of the sensitive region in germanium pin detectors is determined by developing the p–n–junction with dry and liquid electrophotographic developers. Author (NSA)

N66-26023# Iowa State Univ. of Science and Technology, Ames. Inst. for Atomic Research.
INSTRUMENTATION FOR CONTINUOUS AVERAGING OF MAGNETIC SPIN RESONANCE SPECTRA
David R. Torgeson Jan. 1966 18 p refs
(Contract N-7405-ENG-82)
(IS-1312) CFSTI: HC $1.00/MF $0.50

Details are presented for the adaptation of a 400-channel analyzer to be used with a magnetic spin resonance spectrometer for the continuous averaging of wide line spectra. The description includes details of so-called interface circuits between the spectrometer and the analyzer and between the analyzer and the electromagnet power supply control circuits. Two types of studies made with the spectrometer–analyzer system are also described. Author (NSA)

N66-26027# Phylatron Corp., Columbus, Ohio.
DEVELOPMENT OF A HIGH SENSITIVITY FAST NEUTRON DOSIMETER Quarterly Progress Report, 1 Aug.–31 Oct. 1965
B. H. Chase, J. S. Hickman, D. L. Swartz, J. M. Swartz, and M. O. Thurston 30 Nov. 1965 10 p
(Contract AT(11-1)-1226)
(QPR-10; COO-1226-10) CFSTI: HC $1.00/MF $0.50

The design of a silicon-diode dosimeter was completed, and a preliminary badge design was tested. A comparative test of dosimeters was conducted. NSA

N66-26048# Chalmers Univ. of Technology, Goteborg (Sweden).
AN X-RAY CAMERA FOR DISLOCATION STUDIES IN NEARLY PERFECT CRYSTALS
T. Claeson and L. Gerward 1965 21 p refs *Its* Trans. No. 303, (Avd. Allm. Vetenskaper 35)
CFSTI: HC $1.00/MF $0.50

An X-ray camera has been constructed in order to map the dislocation structure in single crystals by different methods. A short description is given of the back-reflection Berg–Barrett method, the transmission Berg–Barrett method (Lang method), the anomalous transmission method, the Auleytner divergent beam method, and the Auleytner method for mosaic structure determination. As X-ray source a micro-focus X-ray tube has

been used. A slit adjustable from 1μ to 2 mm is included. The crystal can be rotated and tilted in three orthonormal planes. Motors, micro-switches, and relays give automatic oscillating of the crystal and/or scanning of the crystal relative to the incident X-ray beam. A photographic emulsion can be placed close to the crystal or at the periphery at a distance of 10 cm from the crystal. The latter filmholder can be fixed or oscillated together with the crystal. A description of the camera and some preliminary results on a germanium crystal of high perfection and on a Ge–Si crystal (7 atom% Si) are presented. Author

N66-26061# European Atomic Energy Community, Brussels (Belgium).

MEASUREMENT OF VAPOUR PRESSURES OF HIGH-BOILING AND HIGH-MELTING ORGANIC SUBSTANCES BY MEANS OF AN ISOTENISCOPE [MESSUNG DER DAMPFDRUCKE VON HOCHSIEDENDEN UND -SCHMELZENDEN ORGANISCHEN STOFFEN MITTELS EINES ISOTENISKOPS]

H. Luhleich and G. Hodapp Nov. 1964 17 p refs In GERMAN; ENGLISH summary
(EUR-2170.d) CFSTI: HC $1.00/MF $0.50

A new type of isoteniscope is described for the measurement of the vapor pressure of high-boiling and -melting substances by means of the static method. Gallium is used as sealing liquid. This apparatus was employed to measure o- and p-terphenyl vapor pressures up to about 5000 mm Hg. Author

N66-26086# Joint Publications Research Service, Washington, D. C.

IZVESTIYA VUZOV: INSTRUMENT BUILDING, NO. 6, 1965

12 May 1966 233 p refs Transl. into ENGLISH of Izv. Uchebn. Zavedenii, Priborostr. (Leningrad), v. 8, no. 6, 1965 p 1–181 (JPRS-35471; TT-66-31907) CFSTI: $6.00

A collection of articles on radioelectronic instruments, electrical measuring instruments and devices, automation and telemechanics instruments and devices, computational instruments and devices, hydroscopic and navigational instruments, precision mechanics instruments, optical instruments, thermal instruments, and general problems of instrument building is presented. For individual titles, see N66-26087–N66-26119.

N66-26101# Joint Publications Research Service, Washington, D. C.

THE EFFECT OF SENSOR AND DATA INPUT SYSTEM DYNAMIC ERRORS ON THE PRECISION OF AUTOMATIC COORDINATE COMPUTERS

V. O. Chernyshev *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1965 p 85–94 refs (See N66-26086 14-14) CFSTI: $6.00

The accuracy of data input systems in calculating a ship's geographic coordinates by automatic computers is examined. The effects of the dynamic errors of electric recorders, gyroscopes, compasses, and tracking systems on the precision of these computers are assessed. Expressions are obtained which indicate that the error of the automatic coordinate indicator depends on the form of the function which determines the periodic error of the data input system. These expressions also show that the relative error caused by periodic sinusoidal errors of the course input system is half of the corresponding error for the step changes in the periodic error. It is concluded that these dynamic errors should be excluded during the design stages of automatic navigational apparatus. H.S.W.

N66-26102# Joint Publications Research Service, Washington, D. C.

DERIVATIONS OF A GYROSCOPE WITH A VARIABLE KINETIC MOMENT AND A DISPLACED CENTER OF MASS AT CONSTANT OVERLOADS

D. V. Lebedev and S. I. Makarikhin *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 95–103 refs (See N66-26086 14-14) CFSTI: $6.00

The causes of the deviations of a free gyroscope with a variable kinetic moment at constant overloads are investigated. The variation of the kinetic moment with time is approximated by the function H–Ho-ht. The motion equation investigations are made by Bondar's method. Author

N66-26103# Joint Publications Research Service, Washington, D. C.

THE CALCULATION OF AERODYNAMIC MOMENT OF RESISTANCE OF A GYROSCOPE DRIVE OPERATING IN AIR

B. A. Delektorskiy and I. N. Orlov *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 104–111 refs (See N66-26086 14-14) CFSTI: $6.00

The data derived from experimental investigations were used to calculate the aerodynamic moments of resistance of gyroscope drives operating in air. Expressions are given for the aerodynamic moment of resistance of an elementary section of the flywheel as well as for the total flywheel surface. The use of these expressions in deriving the resulting engineering formulas is discussed, and a table is provided in which the calculated data is compared to the test data. H.S.W.

N66-26104# Joint Publications Research Service, Washington, D. C.

MOTION OF AN INTEGRATING GYROSCOPE WITH DRY FRICTION

N. V. Butenin and A. M. Lestev *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 112–121 refs (See N66-26086 14-14) CFSTI: $6.00

The motion of the axis of an integrating gyroscope which is experiencing dry friction is considered. Expressions are given which define the system, and equations are derived which satisfy the specified parameters. It is stated that the forces of dry friction introduce a number of peculiarities into the motion of the axis of the integrating gyroscope, and that a critical value of the angular velocity of the base exists. Additionally it was found that for certain relationships between the parameters of the gyroscope and the vibration, the dry friction forces cause a new type of motion—motion with long pauses. It was concluded that the unsymmetrical dry friction forces cause a systematic deviation of the axis from the initial position, and the greatest errors due to the dry friction forces are caused when the axis moves with long pauses. H.S.W.

N66-26105# Joint Publications Research Service, Washington, D. C.

ELECTROMECHANICAL OSCILLATION COUNTER

G. I. Sidorenkov *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 122–125 refs (See N66-26086 14-14) CFSTI: $6.00

The operating principle of an electromagnetic low frequency oscillation counter is described. It is stated that the device may be used for the measurement of the oscillation frequency of physical systems when it is necessary to take into consideration each separate oscillation. A schematic diagram of the device is shown and the interrelationship of its component parts is discussed. H.S.W.

N66-26106# Joint Publications Research Service, Washington, D. C.

CENTRIFUGAL-TANGENTIAL ANGULAR VELOCITY SENSOR

A. A. Vinogradov and A. V. Fokin *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 126–133 refs (See N66-26086 14-14) CFSTI: $6.00

The article describes a centrifugal–tangential angular velocity sensor. The dynamics of the considered sensor are described and formulas for the determination of its parameters are given. Author

N66-26107# Joint Publications Research Service, Washington, D. C.

DEVICE FOR AUTOMATIC RECORDING OF FUEL CONSUMPTION

P. L. Brail'chuk, P. L. Brail'chuk, and Ye. A. Mironov *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 134–137 (See N66-26086 14-14) CFSTI: $6.00

The article describes the design of a piston consumption meter for measuring the fuel consumption of automobile engines in laboratory and operational tests. Author

N66-26108# Joint Publications Research Service, Washington, D. C.

DIFFERENTIAL NULL METER FOR INDICATING CAM PROFILES BY THE TRACING METHOD

A. I. Solov'yev *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 138–140 refs (See N66-26086 14-14) CFSTI: $6.00

It is stated that standard cam tracers are equipped with two indicators; one of which is in contact with the tracer profile, and the other is in contact with the profile of the manufactured cam. The profile error is then evaluated visually by observing the differences between the two indicators. A symmetrical lever differentiator is proposed for evaluating cam profiles to eliminate the errors inherent in the visual evaluations. The operating principle of the device is discussed and schematic diagrams of two variations of the device are shown. H.S.W.

N66-26109# Joint Publications Research Service, Washington, D. C.

OPTICAL RANGE FINDER ARRANGEMENTS WITH A CONSTANT INSTRUMENT BASE AND MIRROR COMPENSATORS

I. A. Greym and S. V. Orlovskiy *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 141–147 ref (See N66-26086 14-14) CFSTI: $6.00

Range finder configurations are considered for possible use as optical compensators and focusing systems for moveable plane mirrors. Since the range finders investigated were designed basically for the measurement of small distances, it was necessary to change the focusing of its optical system and the parallax angle. Attempts to solve this problem for the general case necessitated finding means for the coordination of the convergence angles and light beams. A solution for this problem is offered; a diagram of a range finger with a movable angular mirror is shown; and an analysis of this arrangement is given. H.S.W.

N66-26111# Joint Publications Research Service, Washington, D. C.

MACHINE TIME FOR GRINDING AND POLISHING OPTICAL GLASS

O. A. Sergeyev *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 154–158 refs (See N66-26086 14-14) CFSTI: $6.00

A formula is derived for calculating the machine time necessary to repair abrasions in optical glass. The machine time is calculated as a ratio of the crushed glass to be removed to the intensity of the abrasion. H.S.W.

N66-26119# Joint Publications Research Service, Washington, D. C.

A SIMPLE FAILURE INDICATOR

A. A. Bessonov and V. A. Sivakov *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 202–205 refs (See N66-26086 14-14) CFSTI: $6.00

A device for automatically indicating failures in a system is described. A block diagram and a circuit diagram of the instrument are shown and its operating principles are discussed. H.S.W.

N66-26160# Joint Publications Research Service, Washington, D. C.

ELECTROCHEMICAL PRESSURE PICKUPS

B. R. Lazarenko, S. P. Fursov, and A. A. Faktorovich *In its* Electron. Treat. of Mater. 2 May 1966 p 80–82 refs (See N66-26150 14-34) CFSTI: $4.00

Relationships between the effective values of the current and pressure above an electrolyte surface have made it possible to develop a new method of measuring the gas pressures. The measuring unit, an electrochemical pressure pickup, has advantages over conventional pressure pickups in its simplicity, universality, and mainly because it converts the pressure value into a high power output signal. The method can also be used for measuring the gas pressure in pulsing lines. The quick response of the pickup is determined by the interruption frequency of the current which can be brought up to several kilocycles. Its unfavorable feature is that the current value is dependent on the electrolyte temperature. R.N.A.

N66-26174# Texas Univ., Austin. Defense Research Lab.

[SOLION UNIVERSAL SEISMOMETERS] Status Report No. 8, 1 Oct. 1965–8 Feb. 1966

D. W. Evertson 2 May 1966 21 p (Contract CGS-1198)

Three solion universal seismometer and amplifier units were delivered. Three fixed voltage gains and plug-in filter circuits enable the seismometers to duplicate closely the response of the WWSS. Solion transducer and frame noise limit magnification in the long period mode. Solion design and noise studies will have top priority in future work under the contract extension. Present noise in the solion transducer may conceivably originate from current fluctuations, fluctuating electrolysis rate, breakdown of oxide insulation on the cathode masking plates, convection currents, or a combination of such causes. Steps will be taken in future work to provide a seismometer that will make the most of the capability of each component in its construction. Author

N66-26183# Library of Congress, Washington, D. C. Aerospace Technology Div.

AEROSPACE INSTRUMENTATION Survey of Soviet Scientific and Technical Literature

15 Dec. 1965 60 p refs Compilation of abstracts (ATD-P-65-113)

This compilation of abstracts is based on Soviet open sources published 1964–1965. It is the second in a series of reports reviewing Soviet developments in aerospace instrumentation. Information not directly related to the assigned subject has been included because of the broad implications for study in this field. Of the 44 abstracts (arranged alphabetically by author within each category) 3 deal with magnetometer studies, 1 deals with gravity gradient meters, 7 deal with

cosmic and corpuscular radiation detection, 25 deal with electromagnetic radiation detection, 1 deals with pressure sensors, and 7 deal with associated studies. Abstracts include information on soft electron flux measurement, cosmic radio emission, scientific space station, stratospheric ion concentration, far IR bolometer, electrostatic analyzer, measuring circuit, aerial spectrometer, steel-cathode counter, and a rocketborne resistance thermometer. There are 44 entries in the bibliography. Author

N66-26200# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
INVESTIGATION OF INFLUENCE OF CAMERA PROPERTIES ON ACCURACY OF SPATIAL RECONSTRUCTION OF RECORDED EVENTS [ISSLEDOVANIE VLIYANIYA KHARAKTERISTIK FOTOKAMER NA TOCHNOST VOSSTANOVLENIYA PROSTRANSTVENNOI KARTINY REGISTRIRUEMYKH IMI SOBYTII]
V. G. Ivanov 1965 8 p refs In RUSSIAN
(JINR-P-2468)

Methods for determining the properties of cameras and their influence on the accuracy of calculating the spatial coordinates are considered. It is shown that the application, for stereophotography, of cameras with identical properties and small inaccuracies essentially simplifies the geometric reconstruction of events recorded in bubble chambers. Selection criteria of cameras are given to carry out accurate photogrammetrical investigations. Author (NSA)

N66-26299# Systems Research Labs., Inc., Dayton, Ohio.
DEVELOPMENT OF A HIGH RESOLUTION RESEARCH TELEVISION SYSTEM Final Report, Jul.–Sep. 1965
John H. Harshbarger Wright-Patterson AFB, Ohio. AMRL, Dec. 1965 27 p
(Contract AF 33(615)-3144)
(AMRL-TR-65-235; AD-630941) CFSTI: HC $1.00/MF $0.50

As a basis for the evaluation of high resolution television displays for their possible application to visual simulation training technique, a high resolution television system was developed to provide high quality signals which will drive the display devices which were to be evaluated. As a result of previous research, a 1029-scanning line television system had been developed. Limitations in this single camera arrangement restricted the research which could be conducted into high resolution devices. A larger, higher quality system was required to carry the research study to greater levels of performance with less effort lost due to maintenance and adjustment. The system constructed combines newly purchased devices modified as required for the application together with some specially developed items and other government furnished equipment which was modified and integrated into the system. The design approach which led to the particular system concept employed is explained also. The equipment itself is described in detail with schematics and interconnection diagrams provided for special pieces of equipment. The effort is considered successful, as documented by photographs of displays achieved through the system.
Author (TAB)

N66-26300# Systems Research Labs., Inc., Dayton, Ohio.
TEST EVALUATION OF ELECTRONIC IMAGE GENERATION AND PROJECTION DEVICES. VOLUME III: EVALUATION OF PROJECTION SCREENS Final Report, Jul. 1964–Jul. 1965
John H. Harshbarger and James D. Basinger (AMRL) Wright-Patterson AFB, Ohio. AMRL, Dec. 1965 68 p refs
(Contract AF 33(615)-1889)
(AMRL-TR-65-116, Vol. III; AD-630659) CFSTI: HC $3.00/MF $0.75

The report presents data from an evaluation of seven types of projection screen surfaces to determine which surface best meets the requirements of visual simulation for astronautical flight training. In order to evaluate the various screen surfaces in terms of their brightness and the angle through which incident light is reflected, methods of measurement were devised which compared each screen to a given reference surface. Two materials were tried as the reference surface, the traditional matte white surface of magnesium carbonate and a special type of white paint applied to masonite. The latter surface reflected the more uniform pattern of light, but proved difficult to duplicate due to the great care needed to apply the paint evenly. Thus the report recommends continued use of magnesium carbonate block as the standard reference for display screen measurements. The test data on the seven screen surfaces indicates a wide variation in display characteristics. Apparently the user must accept an appropriate compromise between brightness and viewing angle—the more confined the viewing angle the brighter the display. It was also noted that flaws in the screen surface are particularly apparent in the more directive, brighter screen materials. It is thus essential that screens employing such materials be manufactured with extreme care. Author (TAB)

N66-26301# ARO, Inc., Arnold Air Force Station, Tenn.
DEVIATIONS FROM INTEGRATING SPHERE THEORY CAUSED BY CENTRALLY LOCATED SAMPLES
J. P. Dawson, D. C. Todd, and B. E. Wood Arnold Eng. Develop. Center, Apr. 1966 42 p refs Submitted for Publication
(Contract AF 40(600)-1200)
(AEDC-TR-65-271; AD-630899) CFSTI: HC $2.00/MF $0.50

A review of the assumptions made in the theory of the classical integrating sphere is given. The validity of these assumptions as applied to a modified integrating sphere is discussed in terms of a computer analysis and experimental data. The results of the analysis indicate that a possible error of 15 percent may be introduced into the absolute reflectance determinations. This can occur when the classical theory is applied to a modified integrating sphere using the angular-hemispherical technique. The parameters considered in the analysis are irradiance, sphere radius, sample reflectance, specular component of the sample, angle of incidence, and detector location. Author (TAB)

N66-26357# ITT Federal Labs., Fort Wayne, Ind.
UNIQUE SCAN CLOSED-LOOP TELEVISION SYSTEM Final Report, Jun. 1964–Jun. 1965
Robert V. Quinlan and John A. Holmquist Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 124 p refs
(Contract AF 33(615)-1906)
(AMRL-TR-65-215; AD-630905) CFSTI: HC $4.00/MF $1.00

In the Phase I portion of this effort, a study of display components and techniques was undertaken to determine a feasible method of implementing a closed-loop television system which does not have the objectionable line structure and false reference cues of a conventional raster scan TV system. The result of this study was the recommendation to design and fabricate a closed-loop television system employing conventional raster scan and additional vertical deflection

signals to break up the line structure and produce a more nearly flat field. The additional deflection signals were to be sine waves of frequencies (1) in the range of 100 to 500 kilocycles and (2) approximately 20 megacycles. Phase II of this effort describes the design and evaluation of the recommended system. The basic pickup device employed is an electrostatic vidicon operating in a hybrid mode and the display device is a dual deflection cathode ray tube (CRT). The raster scan is generated by means of the magnetic deflection components and the additional vertical deflection is applied to electrostatic deflection plates. The primary display parameters are 945 lines, 30 frames per second, two-to-one interlace; however, provision is made for operation at 525 lines, 60 frames per second, two-to-one interlace. High frequency deflection was found to be the most effective means of reducing line structure. Low frequency sine wave deflection aids breakup of line structure but, in some cases, introduces objectionable effects such as moiré patterns and flicker.
Author (TAB)

N66-26399# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
MAGNETIC BETA-SPECTROMETER WITH TWO-FOLD FOCUSING AT THE ANGLE $\pi\sqrt{2}$
I. Adam, V. G. Chumin, Yu. N. Denisov, M. Finger, K. Ya Gromov et al 13 Dec. 1965 15 p refs Submitted for Publication
(JINR-E-2494)

A betaspectrometer with two-fold double focusing at the angle $\pi\sqrt{2}$ is considered. The resolving power of the spectrometer is 0.21% when a 1×15 mm^2 source and a solid angle of about 0.1% of 4π is being used. The equilibrium orbit radius is 140 mm. The accidental coincidence background of three counters (the value of the magnetic field corresponds to the focusing of 4 Mev electrons) is smaller than 1 pulse per 15 hours for a ^{166}Tm source of about one millicurie. The proton resonance with running water method for measuring the magnetic fields is used, which allows to determine the energy of the conversion electrons to an accuracy better than 0.08%. All the processes on the betaspectrometer except the measurement of the magnetic field are automatized.
Author (NSA)

N66-26405# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
A TWO-CHAMBER IONIZATION GAUGE [EIN ZWEIKAMMER-IONISATIONS MANOMETER]
E. W. Baluth and G. Venus Jun. 1965 43 p refs In GERMAN; ENGLISH summary
(IPP-2/39)

In order to avoid perturbations of the pressure measurement with an ionization gauge caused by the interaction of the electron gun with the gas in the volume to be measured, a two-chamber ionization gauge was constructed. Electron beam propagation and ionization take place in two spaces separated almost completely as regards vacuum technique. The two-chamber gauge was calibrated for the range from 10^{-1} to 10^{-10} torr and its behavior studied by investigations connected with Blears effect.
Author (NSA)

N66-26430# Utah State Univ., Logan. Electro-Dynamics Labs.
THE EFFECTS OF DIFFRACTION ON OPTICAL DISCRIMINATION Scientific Report No. 4
C. K. Rushforth and R. W. Harris 1 Jan. 1966 34 p refs
(Contract AF 19(628)-3825; ARPA Order 450)
(AFCRL-66-105; AD-630590) CFSTI: HC $2.00/MF $0.50

This report deals with the effects of diffraction and noise on the ability of an optical system to discriminate between two known incoherent intensity distributions. For a particular model of the optical detection process, the optimum discrimination procedure is derived using the techniques of statistical decision theory. Under the assumption of high background intensity, this optimum procedure simplifies considerably; and it is this simplified procedure we evaluate. In addition, we consider a reasonable sub-optimum procedure which does not require detailed knowledge of the diffraction pattern. It is shown that a useful performance criterion is the integrated square of the difference between the two diffracted intensity patterns under consideration. This quantity is evaluated numerically as a function of aperture size for various situations. Typically, it is seen that ability to discriminate drops off quite rapidly as the size of the Airy disc approaches the size of the objects (referred to the image plane).
Author (TAB)

N66-26431# Air Force Cambridge Research Labs., Bedford, Mass. Data Sciences Lab.
THE INFLUENCE OF REPETITION RATE ON APPARENT MOVEMENT Interim Report
Floyd H. Cook and John C. Mott-Smith Feb. 1966 18 p refs *Its* Phys. Sci. Res. Paper, No. 194
(AFCRL-66-86; AD-630607) CFSTI: HC $1.00/MF $0.50

If two similar visual forms displaced by some distance are presented in sequence for brief durations, the illusion of movement can occur. This phenomenon is important to motion pictures and television in particular, where it is used to convey the impression of motion to the viewer. The report describes an experimental attempt to determine the influence of repetition rate of the stimuli on the observation of the phenomenon. For the experiment, all factors were held constant except the spatial and temporal intervals between the two stimuli. The results clearly indicate that the repetition rate of the stimuli has a substantial effect on the perception of apparent movement.
Author (TAB)

N66-26450# Bettis Atomic Power Lab., West Mifflin, Pa.
DEVELOPMENT OF PHOTOGRAMMETRIC TECHNIQUES FOR MEASURING SURFACE CONTOURS OF SMALL SAMPLES
Y. Solomon, S. W. Bohn, and W. J. Dimond (Aerial Mapping Serv., Inc.) Mar. 1965 11 p Presented at the 13th Conf. on Remote Systems Technol. Submitted for Publication
(Contract AT(11-1)-GEN-14)
(WAPD-T-1815; CONF-661001-1) CFSTI: HC $1.00/MF $0.50

A photogrammetric technique using a stereomicroscope that can be used in measurements requiring precision of ±50 μ in., by magnification at the various stages of photographing, printing, and projection, is described. Correction for lens distortion can be determined and eliminated by adjustment of the plotter or elimination of the distorted portion of the negative by enlargement and projection of the center portion. The system can be calibrated directly without interjection of empirical formulas, and provides a permanent visual record of the measured component.
NSA

N66-26487# General Electric Co., Schenectady, N. Y. Research and Development Center.
TIME-OF-FLIGHT SPECTROMETER Quarterly Report
G. C. Baldwin Feb. 1966 10 p
(Contract Nonr-3942(00))
(QR-13; AD-630438) CFSTI: HC $1.00/MF $0.50

Activity consisted largely of transmission experiments with the noble gases, principally He and Ar. Preliminary total cross sections in the range 0.2–1.0 v deduced from these data agree closely with other measurements. These experiments have brought to light several new problems. Their origin and probable solutions are discussed. TAB

N66-26505# Navy Dept., Washington, D. C.
THE USE OF A DEEP-WATER GAMMA RADIOMETER FOR THE MEASUREMENT OF RADIOACTIVITY IN THE OCEAN [PRIMENENIYE GLUBOKOVODNOGO GAMMA-RADIOMETRA DLYA IZMERENIYA RADIOAKTIVNOSTI V OKEANE]
L. M. Khitrov and K. A. Kotlyarov 1966 20 p refs Transl. into ENGLISH from the publ. "Radioactive Contamination of Oceans and Seas" Moscow, Acad. of Sci. USSR, 1964 p 170–182
(ONI-TRANSL-2120; TT66-60744; AD-629672) CFSTI: HC $1.00/MF $0.50

Conclusion: There was created an original automatic deep-water gamma-radiometer with a sensitivity threshold of 2×10^{10} curie, intended for the measurement of total natural radioactivity (r/a) at the maximum depths of the oceans of the world. During measurements of the gamma-background of the depths of the central and northern parts of the Indian Ocean in 1960, there was not found any increase in the r/a level exceeding the natural level by more than 2–3 times.
Author (TAB)

N66-26547*# Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Operations.
LARGE SIZE CRYOGENIC TURBINE TYPE FLOWMETER TECHNOLOGY
G. R. Deppe 1 Jun. 1966 53 p refs
(Contract NAS3-2555)
(NASA-CR-54810; AGC-8800-60) CFSTI: HC $3.00/MF $0.75
CSCL 14B

The procurement, calibration, facility installation, and use of turbine flowmeters for the very large liquid oxygen/liquid hydrogen components of the M-1 Rocket Engine are described. Also, construction details of one turbine flowmeter and limited calibration data for several turbine flowmeters are given. The relative capabilities of the nation's major testing organizations are presented along with facility recommendations. Author

N66-26670# Air Force Cambridge Research Labs., Bedford, Mass.
DEVICE FOR RAPID ORIENTATION OF CRYSTALS BY DIRECT-IMAGE X-RAY TECHNIQUE
Ferdinand Euler Feb. 1966 23 p refs *Its* Instrumentation Papers No. 93
(AFCRL-66-106; AD-630931)

A device was designed, built, and tested, which facilitates the rapid orientation of crystals by direct inspection of an electronically intensified optical image of their Laue patterns. Remote controls permit the rotation of the sample about two axes during the X-ray exposure. The pattern can also be recorded on fast Polaroid film. The operating characteristics of the device are described. Author (TAB)

N66-26725# Navy Electronics Lab., San Diego, Calif.
PRESSURE VESSEL FOR CALIBRATING SONAR TRANSDUCERS. ACOUSTICALLY TRANSPARENT FIBER GLASS CAPSULE PERMITS TESTING AT PRESSURES TO 800 PSIG Research and Development Report, Oct. 1964–Mar. 1965
C. E. Green 26 Jul. 1965 21 p
(NEL-1301; AD-623166) CFSTI: HC $1.00/MF $0.50

Acoustically transparent vessel houses a single transducer for testing under pressure to 800 psig. Tests of B24FA transducer indicate marked difference in transmitting response at depth. Author (TAB)

N66-26731# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
THEORETICAL AND EXPERIMENTAL RESULTS FOR THE DYNAMIC RESPONSE OF PRESSURE MEASURING SYSTEMS
H. Bergh and H. Tijdeman Jan. 1965 20 p refs Submitted for Publication
(NLR-TR-F.238) CFSTI: HC $1.00/MF $0.50

A method is presented to predict theoretically the dynamic response characteristics of pressure measuring systems consisting of thin tubes connected to a pressure transducer. The influence of the different parameters has been demonstrated and comparisons with experiments are given which show an accurate agreement. Author

N66-26787# Dow Chemical Co., Denver, Colo. Rocky Flats Div.
A STUDY OF THERMISTOR STABILITY
C. A. Pippin 14 Dec. 1965 9 p
(Contract AT(29-1)-1106)
(RFP-649) CFSTI: HC $1.00/MF $0.50

The stability of two Fenwall GB31J1 thermistors was investigated, using two crystal ovens. It was determined that the thermistors are stable within the accuracy normally required for use with accurate readout equipment. NSA

N66-26791# Los Alamos Scientific Lab., N. Mex.
ELECTRICAL CHARACTERISTICS OF COAXIAL CABLE
Grenfell P. Boicourt 15 Nov. 1965 6 p
(Contract W-7405-ENG-36)
(LA-3318) CFSTI: HC $1.00/MF $0.50

A pulsed ringing method was used to measure the inductance and resistance of several special coaxial cables used at the Los Alamos Scientific Laboratory as transmission lines in banks for controlled thermonuclear research. The cables are described, the method of measurement is outlined, and the properties of the cables are given. Author (NSA)

N66-26795# Los Alamos Scientific Lab., N. Mex.
AN ULTRA-HIGH VACUUM THERMOBALANCE FOR LANGMUIR VAPORIZATION STUDIES; VAPOR PRESSURE OF MOLYBDENUM
R. Jay Fries 24 Jan. 1966 22 p refs
(Contract W-7405-ENG-36)
(LA-3423) CFSTI: HC $1.00/MF $0.50

An ultrahigh vacuum thermobalance suitable for Langmuir evaporation rate studies at temperatures from 1200 to 3000°K in background pressures of the order of 5×10^{-9} torr is described. The performance of the system was evaluated by measuring the vapor pressure of molybdenum. A heat of vaporization of 157.3 kcal/mole and a pressure-temperature relation of $\log_{10} P(atm) = 7.118 - 3.320\ (10^4/T)$ is recommended. Author (NSA)

N66-26797# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
DESCRIPTION OF A TEMPERATURE MONITOR FOR LARGE REACTORS. PART III: PERFORMANCE

Joseph S. Byrd, Arthur H. Dexter, Malcolm H. Goosey, Carl R. Hutter, Richard W. Leep et al Jan. 1965 32 p
(Contract AT(07-2)-1)
(DP-944) CFSTI: HC $2.00/MF $0.50

The results of accuracy and reliability tests on a monitor that was developed to scan large numbers of thermocouples are presented. TAB

N66-26802# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
COMPILATION OF RESOLUTIONS AND INTENSITIES OF SLOW NEUTRON, INELASTIC SCATTERING, TIME-OF-FLIGHT INSTRUMENTS
R. M. Brugger and Y. D. Harker Jan. 1966 45 p ref
(Contract AT(10-1)-205)
(IDO-17134) CFSTI: HC $2.00/MF $0.50

A compilation of the intensities and resolutions of slow-neutron time-of-flight instruments is presented. The data for the various instruments are compared. NSA

N66-26835# Itek Corp., Lexington, Mass.
STUDY OF IMAGE-EVALUATION TECHNIQUES Interim Engineering Report No. 10, 15 Oct. 1964–15 Jan. 1965
[1965] 84 p refs
(Contract AF 33(657)-9158)
(ITEK-65-9048-11; AD-615647)

The imaging of lines and edges in the presence of off-axis aberrations is discussed. Necessary formulas are derived and typical numerical data for third-order coma are presented. The use of weighting factors in attaining smooth convergence of Fourier series at a discontinuity is investigated. System transfer functions are determined and resolution is predicted using film image analysis. Emulsions are studied using coherent light apparatus. TAB

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N66-25431# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
THE DEVELOPMENT OF A PILOT PLANT FOR URANIUM MONOCARBIDE PELLET MANUFACTURE
D. George Jan. 1966 22 p refs
(AERE-R-5127)

A route is given for the production of 1 Kg. per day of uranium carbide pellets by the cold-pressing and sintering of finely-comminuted powder; equipment and manufacturing procedures are described in detail. Author

N66-25486# United Kingdom Atomic Energy Authority, Springfields (England). Reactor Fuel Element Lab.
THE ROUTINE ULTRASONIC INSPECTION OF SMALL-DIAMETER THIN-WALL TUBING
J. Rooney and A. Reid 1966 32 p refs
(TRG-1133(S))

The development of an ultrasonic method for the sensitive inspection of small-diameter thin-wall tubing in the range 0.18 to 0.5 in. dia. and 0.010 to 0.030 in. wall thickness is described. Three particular problems are distinguished: the preparation of artificial defects for calibration, the useful ultrasonic beam propagated by the ultrasonic probe, and the precise probe-to-tube geometry required for the correct performance of the method. The test equipment is described and typical defects are shown. Author

N66-25497# Metaalinstituut TNO, Delft (Netherlands).
RESEARCH ON A BROKEN DRIVESHAFT [ONDERZOEK VAN EEN GEBROKEN HOOFDDRINFSTANG]
W. Hagg 31 Jan. 1966 13 p In DUTCH
(M-66-91; TDCK-44577) CFSTI: HC $1.00/MF $0.50

Tests were conducted to determine the cause of a break in the drive shaft of a R 1820 engine after about 1000 hours of use. Microscopic research revealed that the drive shaft had been constructed of refined metal with a good microstructure. Results of electromicroscope examinations indicate that the break was due to a fatigue crack rather than the quality of the metal. Transl. by J.O.

N66-25516# Marine Engineering Lab., Annapolis, Md.
INVESTIGATION OF FLEXIBLE PIPING CONNECTIONS
A. L. Smookler Feb. 1966 29 p
(MEL-10/66; AD-630421) CFSTI: HC $2.60/MF $0.50

In evaluation tests conducted as part of the Navy's program for developing flexible pipe connections capable of accepting relative motions caused by vibration, shock, thermal movement and hull deflections, MEL has found two units worthy of further evaluation, one after redesign of sealing arrangement and another after being placed in a new configuration. A third and fourth failed in this phase of the evaluation program. Author (TAB)

N66-25533*# Oklahoma State Univ., Stillwater. Fluid Power Controls Lab.
STUDY OF FILTRATION MECHANICS AND SAMPLING TECHNIQUES, PHASE II Technical Summary Report, 1 Jan.–31 Dec. 1965
Roger H. Tucker, Peter Dransfield, and Kirby L. Stone 1 Mar. 1966 129 p refs
(Contract NAS8-11009)
(NASA-CR-74853) CFSTI: HC $4.00/MF $1.00 CSCL 13H

Some factors affecting the flow and filtration properties of wire cloth media and elements are investigated, e.g., examination of the modes of filtration applicable to wire cloth media, effects of housing design and element configuration on performance, effect of sintering on filtration properties, effect of flow variations on filtration performance, and variation of filter efficiency as the filter media becomes loaded with contaminant. The low pressure sampling technology previously reported was used to develop a sampling device capable of extracting a representative sample of oil from systems working at up to 3000 lb/in^2. The design and performance of the high pressure sampler are described. An initial evaluation of the Silting Index Apparatus used for low micron contaminant analysis is included. Author

N66-25571*# Marquardt Corp., Van Nuys, Calif.
TWO (2) WAY, LATCHING, DC SOLENOID CONTROL VALVE Final Report, 1 Mar.–28 Dec. 1965
R. A. Lynch 3 Jan. 1966 73 p
(Contract NAS9-4069)
(NASA-CR-65340; S-479) CFSTI: HC $3.00/MF $0.75 CSCL 13K

Three two way, latching, dc solenoid control valves suitable for use in hypergolic propellant systems were designed, fabricated, and tested. The valves are intended to isolate reaction control engine clusters from main propellant supply systems in space vehicles. The delivered units incorporate all welded construction to assure minimum external leakage and a fully hermetic seal at the electrical pigtail interface. A summary of demonstrated performance is as follows: (1) internal helium leakage at 360 psig, 0; (2) ΔP at equivalent flow rate of 0.88 pps N_2O_4, 2.55 to 2.90 psi; (3) insulation resistance, greater than 500 megohms/min; and (4) unit weight, 1.565 lbs. D.T.

N66-25572*# TRW Equipment Labs., Cleveland, Ohio.
STRETCH-FORMED ALUMINUM SOLAR CONCENTRATOR
Apr. 1966 80 p refs
(Contract NAS1-4684)
(NASA-CR-66069; TRW-ER-6819) CFSTI: HC $3.00/MF $0.75 CSCL 13H

Results of the investigation of the solar concentrator fabrication technique and mounting ring design are presented. Fabrication of a 60 inch diameter concentrator is described which resulted in an optical accuracy of 1.59 minutes and 2.08 minutes radial and circumferential standard deviation of surface errors respectively. Measured specular solar reflectivity is 88% to 90% and the concentrator weight is 10.75 pounds.
Author

N66-25583*# AVCO Corp., Lowell, Mass. Research and Advanced Development Div.
INVESTIGATION OF 3-D FABRICATION OF ABLATIVE MATERIALS Quarterly Progress Report No. 1, 8 Sep.–7 Dec. 1965
C. T. Hughes, R. W. King, W. Kyros, E. M. Lenoe, and P. J. Roy
22 Dec. 1965 63 p
(Contract NAS9-5207)
(NASA-CR-65353) CFSTI: HC $3.00/MF $0.75 CSCL 13H

Candidate specimens from outside vendors are in house or on order covering sewing, needling, tufting, braiding, and multiple warp techniques. Inquiries on pile fabrics are in progress. Impregnation with epoxy resins has become routine and successful techniques with phenolics or epoxy phenolics appear imminent. Present mechanical test data (room temperature only) give the preliminary indication that these systems can be represented by anisotropic elasticity theory. The physical test matrix, specimen preparation, and thermal shock test design are also discussed in this report. Author

N66-25591# Institut Franco-Allemand de Recherches, St. Louis (France).
CONSTRUCTION OF A TESTING RECEPTACLE IN ORDER TO FORM BY EXPLOSION AND TO DEVELOP A HIGH PRESSURE MEASURING AGENT [KONSTRUKTION EINES VERSUCHSGEFASSES FUR SPRENGFORMUNG UND ENTWICKLUNG EINES HOCHDRUCK-MESSELEMENTES]
W. Daniels, H. Muller, and H. G. Otto 8 Jan. 1964 15 p refs In GERMAN
(Contract T-356-J-206)
(ISL-T-2/64) CFSTI: HC $1.00/MF $0.50

In constructing the receptacle, intended for optical and electric measurings in liquid medium, the following was aimed for: (1) strength; (2) rust inhibition; (3) optimum size; (4) light effects; (5) accessibility; (6) ability to remove bottom and turn the receptacle. A measuring element based on the high pressure coefficient of the electrical resistance of Manganin was used for pressure measurings in the liquid, on the walls, and above the test sample; reliability, sensitivity, and low cost were stressed here. K.W.

N66-25596# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
A REVIEW OF LITERATURE ON FACTORY TECHNOLOGY [LITERATUUROVERZICHT, WERKPLAATSTECHNIEK]
Feb. 1966 25 p refs In GERMAN, ENGLISH, DUTCH, and FRENCH *Its* Vol. 11, No. W-95
CFSTI: HC $1.00/MF $0.50

Abstracts and bibliographic notes are presented on the topics of operations using clamps (turning, sawing, polishing, drilling, spark prevention, and thread fabrication), non-clamp type operations (general, welding, hot and cold forging, presses, depth drawing, and extrusion), other fabrication methods (welding, and warmth and surface treatments), and general information, such as management and organization, rules and regulations, machine parts, and machine tools. Transl. by J.O.

N66-25625# Naval Ordnance Test Station, China Lake, Calif.
THE APPLICATION OF ULTRASONICS TO WIRE DRAWING First Quarterly Progress Report, 1 Jul.–30 Sep. 1965
A. T. Robinson, J. C. Connelly, and L. M. Stayton Nov. 1965 12 p ref
(TPR-420; NOTS-TP-3976; AD-630248) CFSTI: HC $1.60/MF $0.50

Tests to measure draw load reduction versus draw velocity at a constant energy density were repeated for tinned copper wire. It was found that with a pure sine wave inout at the resonant frequency (nominally 20 kilocycles per second) of the system, that parasitic frequencies were self-induced in the wire. The pattern and distribution of energies among the various waves were responsible for further decreases in draw load. Author (TAB)

N66-25637# Royal Swedish Academy of Engineering Sciences, Stockholm.
INVESTIGATIONS OF SOIL COMPACTION BY VIBRATION
Lars Forssblad 1965 199 p refs *Its* Acta Polytech. Scand. Civil Eng. and Building Construct. Ser. No. 34
(CI-34) CFSTI: HC $5.00/MF $1.25

Methods of soil compaction by vibration and types of vibratory compactors are investigated; and the historical development of and earlier investigations in soil compaction are reviewed via a literature survey. Attention is given to measurement methods used in testing, including determination of unit weights, amplitudes, frequencies, accelerations, and pressures. Soil compaction tests made on a laboratory scale are investigated, as is the effect of vibration on internal friction in soil materials. Impact on ground surfaces is considered in terms of falling weight and other effects. Investigations with cohesive soils are mentioned, and details are presented for studies relating to vibratory compaction of cohesionless soils by means of vibrating rollers and plate compactors. Compaction of water-saturated soils with internal vibrators is reviewed; and consideration is given to the risk of damage from vibratory soil compaction to neighboring buildings. Results of many laboratory and field tests are reported. M.W.R.

N66-25654# Institut de Soudure, Paris (France).
CONDITIONS OF EXECUTION AND RESULTS OF WELDING TESTS MADE ON SAMPLE SLABS TAKEN FROM ROLLED STEEL PLATING [CONDITIONS D'EXECUTION ET RESULTATS D'ESSAIS DE SOUDAGE SUR DES TRANCHES PRELEVEES SUR TOLES EPAISSES D'ACIER LAMINE] Final Report
H. Granjon and R. Gaillard Brussels, EURATOM, 1966 94 p In FRENCH; ENGLISH summary
(Contract EURATOM-090-62-12 RDF)
(EUR-2669.f; EURAEC-1517) CFSTI: HC $3.00/MF $0.75

When faced with the problem of welding heavy-gauge plates, e.g., 200 mm or over, it is possible to develop the arc process welding technique envisaged by operating on samples (so-called cuts) taken perpendicular to the skin of the material. Using a cut of a thickness of about 60 mm, the welding operation performed on such a cut is representative of that which will be carried out on the product from the standpoint of thermal cycling, hardness and structure. Author

N66-25655# Netherlands Research Centre TNO for Shipbuilding and Navigation, Delft. Corrosion and Antifouling Dept.
THE PRE-TREATMENT OF SHIP PLATES: A PRACTICAL INVESTIGATION INTO THE INFLUENCE OF DIFFERENT WORKING PROCEDURES IN OVER-COATING ZINC RICH EPOXY-RESIN BASED PRE-CONSTRUCTION PRIMERS [DE VOORBEHANDELING VAN SCHEEPSBOUWSTAAL: EEN ONDERZOEK NAAR DE INVLOED VAN VERSCHILLENDE WERKWIJZEŃ BIJ HET OVERSCHILDEREN VAN ZINKRIJKE EPOXY-VOORBEHANDELINGSVERVEN]
A. M. Van Londen and W. Mulder Dec. 1965 28 p refs *Its* Rept.-80C
(TDCK-44449) CFSTI: HC $2.00/MF $0.50

Investigations are described which concerned the overcoating of zinc rich epoxy–resin based pre-construction primers with underwater ship bottom paint systems. The investigations were of a practical nature and they were carried out by weathering tests and exposure tests in sea water. Two commercial epoxy–zinc rich primers have been used, the compositions have not been disclosed. The results of the tests are discussed and the behavior of said paint systems is considered. The blistering of ship bottom paint systems was found to require a further investigation. The role of zinc rich pre-construction primer in the occurrence of blistering has to be established, as there are indications that the use of this type of primer did not stimulate blistering. The use of a zinc rich epoxy–resin based preconstruction primer improved the rust prevention considerably. Sealing off of this primer coat before weathering had a favorable influence. The usual cleaning methods of the weathered primer coat are not of practical interest, but of course, all loose dirt, oily substances, etc. must be removed before overcoating. The investigations have shown that by using zinc rich pre-construction primers on ships' hulls very good results can be obtained. A working procedure for practice is given. Author

N66-25754# General Dynamics/Convair, San Diego, Calif.
SUPERINSULATION RESEARCH PROGRAM Progress Report, Apr.–Dec. 1965
J. P. Clay, R. C. Getty, T. D. Lange, K. E. Leonhard, and R. E. Tatro Dec. 1965 158 p refs
(GD/C-ERR-AN-863)

Insulation problems associated with long term storage of cryogenics in space were identified and evaluated. Solutions to the problems were investigated analytically, and in some cases experimentally, with emphasis on obtaining the best solution or combination of solutions required for an insulation system. Pure research was performed on the phenomena of residual gaseous conduction. A computer program was developed and used to theoretically analyze thermal performance of composite multilayered insulation systems. Self evacuating multilayered insulation panels were developed, fabricated, and tested. The panels performed well and show promise for use in an insulation system. Methods were developed whereby mylar, or mylar-metal laminates, can be fusion welded to form a vacuum tight seal between the laminates from cryogenic to room temperature. Compressed multilayered insulations for use between liquid H_2 and O_2 or liquid H_2 and F temperatures were investigated. "Flocked aluminized mylar" was investigated as a possible, high performance, multilayered insulation. The use of ideally suspended radiation shields for use on cylindrical tank walls was tested on a thirty inch diameter tank. The effect of a suction line penetration into a cryogenic tank on a multilayered insulation was experimentally investigated. Author

N66-25757# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
THE LOCKSPRAY-GOLD PROCESS
D. J. Levy Apr. 1966 41 p refs
(Rept.-6-76-66-9)

A new process for plating gold with the use of conventional spray guns is described. This is a chemical reduction process in which separate aqueous solutions of a complex gold salt and a chemical reductant are sprayed simultaneously at ambient temperature onto the article to be coated. Plating conditions are designed so that a dense continuous gold film is formed by an autocatalytic deposition mechanism. Some of the advantages of this process over conventional deposition methods are: size of the article to be plated can be almost unlimited; thickness of the deposit can be accurately controlled to any desired value from thin transparent films of 100 Å to coatings as thick as 2 μ or more; complex shapes are easily plated; ambient temperature of the plating solutions enables temperature-sensitive materials such as plastics to be coated; and equipment costs are low compared with electroplating and vacuum evaporation. C.T.C.

N66-25850# General Electric Co., Lynn, Mass. Small Aircraft Engine Dept.
HYDRODYNAMIC COMPRESSIVE FORGING Final Report, 9 Jul. 1962–1 Jul. 1964
Richard M. Cogan Wright-Patterson AFB, Ohio, AF Mater. Lab., Jul. 1964 90 p refs
(Contract AF 33(657)-8793)
(ML-TRD-64-240; AD-604729) CFSTI: HC $3.00/MF $0.75

A manufacturing process development for the production of closed die forgings using hydrodynamic compressive forces at room temperatures is described. Upsetting materials in a cavity first filled with a low strength matrix increases the amount of plastic deformation obtained prior to fracture. The forces necessary to deform materials in this manner can be predicted from the extrusion force required for operation plus what is necessary to overcome the hydrostatic pressure developed by the resistance of the matrix to flow. The materials worked in this program were: a low alloy carbon steel, AISI-4340; a cast nickel base high temperature alloy, SEL-15; an iron base face centered cubic precipitation hardening alloy, A-286; an iron base martensite precipitation hardening alloy, AM-355; a hexagonal close pack (anisotropic) alloy, 6Al-4V titanium; and a body centered cubic refractory alloy, .5Ti molybdenum. Micro and macro examinations of the materials showed the parts produced in this manner to be structurally comparable to conventional cold worked metals. A modification of this method using a doughnut shaped billet filled with a matrix material reduced the die loading stresses. As a consequence, higher strength materials were worked in this manner. Author (TAB)

N66-25854# Mechanical Technology, Inc., Latham, N. J.
FRICTION AND LUBRICATION IN HOT METAL DEFORMATION

Marshall B. Peterson and F. F. Ling 20 Mar. 1966 98 p refs (Contract NOw-65-0363-c)
(MTI-66TR18; AD-630204) CFSTI: HC $3.00/MF $0.75

A study was conducted to investigate the frictional behavior of metals in hot metal deformation. The purpose of the study was to gain a better understanding of friction at high pressures and temperatures characteristic of metalworking processes. A test technique was developed in which a thin foil was compressed between a hardened anvil and a flat plate. Friction was determined by applying a tangential force to one of the specimens. A technique was also developed to evaluate lubricants based upon the surface damage of various pure metals and alloys in both the lubricated and the unlubricated condition, at temperatures to 1800°F and pressures to 200,000 psi. It was found that this test uniquely yielded the friction coefficient of a given metal combination at a particular pressure and interface temperature. The variables found to be most significant in the pressure range 8000 to 200,000 psi are the roughness, temperature, surface oxide, and tool materials. Over this pressure range, friction is primarily determined by the strength of the metal. Adhesion effects modify the friction but primarily determine the extent of metal transfer. TAB

N66-25859# Navy Dept., Washington, D. C.
A MECHANIZED METHOD OF COATING PROPELLER SHAFTS WITH A REINFORCED EPOXY RESIN [MEKHANIZIROVANNYY SPOSOB POKRYTIYA GREBNYKH VALOV ARMIROVANNOY EPOKSIDNOY SMOLOY]
Yu. Razdrogin 1966 7 p Transl. into ENGLISH from Rechn. Transp. (Moscow), no. 11, 1964 p 47–48
(ONI-Transl.-2055; TT-66-60753; AD-629861) CFSTI: HC $1.00/MF $0.50

A method of applying fiber glass reinforced epoxy resin coatings to propeller shafts is described. The machine is diagramed, and the mechanized process is described. A fiber glass tape is wound onto the rotating shaft, and 3 to 5 layers are applied. Precautions to be taken throughout the process are mentioned. N.E.N.

N66-25888# Florida State Univ., Tallahassee. Dept. of Statistics.
NON-PREEMPTIVE PRIORITIES IN MACHINE INTERFERENCE
Vincent Hodgson and Thomas L. Hebble Sep. 1965 18 p refs (Contract Nonr-988(08))
(M-90; ONR-TR-17; AD-623830) CFSTI: HC $1.00/MF $0.50

A model of machine interference is studied in which one repairman is assigned to maintain several batteries of machines with a finite number of machines in each battery. The model, which assumes non-preemptive priorities, random breakdowns and general repair time distributions, is closely analogous to the classical priority queueing model of Kesten and Runnenburg. A system of equations for the multivariate binomial moments of the number of machines working in each battery immediately after a repair is completed, is established and solved. Author (TAB)

N66-25930# Naval Avionics Facility, Indianapolis, Ind.
BONDING OF COMPONENT LEADS AND WIRE CONDUCTORS TO THIN FILM CIRCUITS BY ULTRASONIC WELDING Final Report
Orville W. Slone and William M. Shank 15 Mar. 1966 14 p
(NAFI-TR-764; AD-629946) CFSTI: HC $1.60/MF $0.50

The results of limited tests to determine the weldability of small component lead wires to thin film circuits by ultrasonic welding techniques are reported. Author (TAB)

N66-25948# RCA Service Co., Inc., Alexandria, Va.
CRITERIA FOR VALUE ENGINEERING. PHASE I: FEASIBILITY STUDY Interim Report, Jul.–Nov. 1965
R. E. Purvis and R. L. Mc Laughlin Griffiss AFB, N. Y., RADC, Feb. 1966 48 p refs
(Contract AF 30(602)-3850)
(RADC-TR-65-475; AD-630207) CFSTI: HC $2.00/MF $0.50

The state of the art of value engineering is summarized and a value analysis technique is proposed with the following characteristics: (a) Quantification of value consistent with established USAF specification of system utilization. (b) Value parameters which are predictable and measurable; (c) Systematic method of quantitative analysis which permit practical optimization in the least cost sense consistent with system value. (d) Technique structure which permits design tradeoff of discrete alternatives relating to cost and system value parameters. (e) Method of cost analysis which permits optimization with respect to total cost and is consistent with both design and operational value parameters. (f) Method of cost analysis based on difference principles which permits decisions through dominance of one alternative to another. (g) General method of analysis which permits cost in time and singling out areas significant cost differences between alternatives. TAB

N66-25952# Rock Island Arsenal Lab., Ill.
AN EVALUATION OF THE ULTRASONIC MACHINING PROCESS
Lanny D. Wells Feb. 1966 22 p refs
(RIA-66-526; AD-629973) CFSTI: HC $1.00/MF $0.50

An evaluation of the ultrasonic machining process was made based on experience with a commercial unit and an intensive literature review. Ultrasonic machining is a practical solution to some machining tasks which are difficult because of workpiece characteristics or because of a requirement for a complex shape or profile in the finished part. However, because of the low machining rates obtainable and other disadvantages of the process, it is limited to machining operations for which no other satisfactory method can be found. Author (TAB)

N66-26026# General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation.
DEVELOPMENT AND EVALUATION OF A HOMOGENEOUS W-25Re ALLOY FOR 2600°C APPLICATIONS
W. G. Baxter, C. O. Tarr, and J. A. Mc Gurty [1965] 15 p refs Presented at the 6th Ann. Structures and Metals Conf., Palm Springs, Calif., 5–7 Apr. 1965
(Contract AT(40-1)-2847)
(GE-TM-65-2-18; CONF-650449-1) CFSTI: HC $1.00/MF $0.50

Fabrication procedures were developed which result in an homogeneous W–25Re alloy. Sheet, tubing, and rods were successfully fabricated with homogeneous structures. The properly processed alloy has low impurity content, is resistant to forming porous areas in welding, and has room-temperature bend ductility after heating at 2200° to 2600°C. Creep-rupture properties at 2600°C in H_2 are improved in laboratory-produced homogeneous W–25Re sheet when compared to commercially produced sheet. Brazed commercial sheet and electron-beam welded homogeneous sheet creep-rupture specimens demonstrated acceptable strength at 1600°C in hydrogen. Author (NSA)

N66-26064# European Atomic Energy Community, Brussels (Belgium).

MECHANICAL RADIOGRAPHY TECHNIQUES FOR THE QUALITY CONTROL OF THIN WALLED SAP TUBES [PROCEDES DE RADIOGRAPHIE MECANIQUE APPLIQUES AU CONTROLE DE QUALITE DE TUBES A PAROIS MINCES EN S.A.P.]

P. Bonnet and J. Jansen Jun. 1965 48 p In FRENCH; ENGLISH summray
(EUR-2443.f) CFSTI: HC $2.00/MF $0.50

For the control of light tubes intended for nuclear application, radiography may be quite useful if precautionary measures are taken as to the contrast. Furthermore one-wall techniques avoid the superimposition of images as observed in conventional radiography. Two one-wall techniques have been described and analyzed: the so-called rotative method and the rolling method. In the rotative method the film is rolled up on an expansible mandrel introduced into the tube by a special tool. The assemblage is then primed by a uniform rotative movement and exposed to X-rays collimated by a slit of adjustable width. The analysis of the method suggests that the focal distance may be short. By contrast, the slit must be small which leads to rather long, but not prohibitive, exposition periods. According to the rolling method a film carriage rolls at a velocity that approaches the peripheral velocity of the tube. The image of the wall becomes very fuzzy whereas that of the back wall rests sufficiently clear. The more intricate mathematical relations between the parameters necessitated digital computation. Greater widths of slit are acceptable in this case without impairing the quality of the image. Author

N66-26067# Lockheed Missiles and Space Co., Sunnyvale, Calif.

LOCKHEED MULTILAYER INSULATION INDEPENDENT DEVELOPMENT PROGRAM (1963-1964) Final Report

[1964] 105 p refs
(LMSC-A777990)

This report presents the results of a multilayer insulation development program conducted to develop lightweight radiation shields for insulating spacecraft cryogenic propellant tanks. Insulation materials were selected on the basis of weight, ability to withstand the anticipated environments, ease of handling and fabrication, and availability and cost. After a preliminary screening, three radiation shields and two spacers were chosen for testing. The test program involved thermal-mechanical tests of materials and small scale insulation attachment specimens, calorimeter tests of insulation and attachment concepts for basic thermal data, and environmental tests of insulated scale model tanks. Detailed descriptions of the candidate materials, the systems into which they were assembled, the test program and results, and synopses of pertinent analytical studies performed in support of the program are presented. R.N.A.

N66-26117# Joint Publications Research Service, Washington, D. C.

AN ANALYSIS OF THE CONDITION OF THE SURFACE LAYER OF METAL IN SIMULTANEOUS TURNING AND BURNISHING

A. A. Vyallo *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 188-193 refs (See N66-26086 14-14) CFSTI: $6.00

After simultaneous turning and burnishing, investigations were conducted to analyze the effects of these processes on the microstructure and microhardness of metals. The device used for conducting the simultaneous turning and burnishing is described, and its operating principles are discussed. The results of the analysis are illustrated in graphs. It was determined that an increase in the microhardness takes place and that the microstructure is not changed significantly. It is stated that these investigations established the feasibility of using this method for finishing metal instrument parts without affecting such physical properties as electrical conductivity, thermal conductivity, and magnetic properties. H.S.W.

N66-26118# Joint Publications Research Service, Washington, D. C.

A COMPARATIVE ANALYSIS OF THE TURNED, GROUND, BURNISHED AND VIBRO-BURNISHED SURFACES FOR WEAR AND SEIZURE

L. A. Bunga *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 194-201 refs (See N66-26086 14-14) CFSTI: $6.00

Steel bearing specimens were used and the experimental procedures are described in detail. The results of the investigations into the effects of the size of the bearing surface on the resistance to seizure are illustrated in a diagram. In analyzing this diagram, it is stated that the resistance to seizure is determined by the size of the bearing surface and by the shape of irregularities and their uniformity. Friction with and without lubrication was also considered, and it was determined that the character of the change in the moment of friction in the seizure is analogous to the change in the specific pressure. Fluid friction does not change the character of the relationships, but delays the instant of the seizure approximately 2.5 times. Additional conclusions are drawn and evaluated. H.S.W.

N66-26149*# Jet Propulsion Lab., Calif. Inst. of Tech, Pasadena.

PRESSURE DISTRIBUTION IN A HYDROSTATIC BEARING OF MULTI-WELLS

Sandra M. Barondess, Horace P. Phillips, and Senol Utku 1 Mar. 1963 28 p refs
(Contract NAS7-100)
(NASA-CR-74884; JPL-TM-33-119) CFSTI: HC $2.00/MF $0.50 CSCL 13I

The Navier-Stokes equations are first specialized for very slow motion to obtain the equation governing the pressure distribution in the hydrostatic bearing. The resulting differential operator of the governing equation is the Laplacian. The solution domain is rectangular and contains two or three pairs of symmetrically located wells of rectangular shape. Any one of the wells may be considered to have unit pressure while the remaining wells and the outside boundaries of the pad have zero pressures. Since the system is completely linear, the pressure distribution on the pad with arbitrary well pressure combinations can be obtained by superposition. The differential equation is solved numerically with the aid of a digital computer. The differential equation is converted to a set of linear simultaneous equations through a finite difference scheme. The coefficient matrix is tridiagonalized through suitable partitioning. Because of the quasi-tridiagonal property of this matrix, the solution is obtained by an upper-lower procedure. Since this procedure causes considerable round-off errors when applied to large sensitive systems, an optional interation with single steps is provided. Author

N66-26151# Joint Publications Research Service, Washington, D. C.

NEW APPLICATIONS FOR ELECTRICITY IN INDUSTRY AND AGRICULTURE

B. R. Lazarenko *In its* Electron. Treat. of Mater. 2 May 1966 p 1-10 (See N66-26150 14-34) CFSTI: $4.00

This article discusses new Soviet applications of electricity in the fields of metallurgy, metal working, chemistry, biology, and agriculture. Some of the applications discussed include the use of electron beams for melting, zone refining, and welding metals; electrospark machining; electric discharge for inducing chemical reactions; electric sterilization and processing of food; and electric control of plant germination. R.N.A.

N66-26152# Joint Publications Research Service, Washington, D. C.

THE METHOD AND EQUIPMENT FOR THE INVESTIGATION OF ELECTRIC EROSION BY REPEATED DISCHARGES

A. A. Namatevs and G. A. Ostroumov *In its* Electron. Treat. of Mater. 2 May 1966 p 11–15 refs (See N66-26150 14-34) CFSTI: $4.00

This report describes a method and its associated equipment for determining the electric erosion of metals by repeated discharges. The method involves the successive oscillographing of the discharge processes taking place under the same initial energy conditions which are taken from the statistical distribution of the breakdown voltage with the aid of a differential amplitude discriminator. The oscillograms show only the properties of those sections of the electrode surfaces between which the discharge appears directly. The oscillographing can be performed by using an OK-17M two beam oscillograph and Negativ-DK type photographic material. The voltage from the discharge gap is supplied directly to the deflecting plates of the electron beam tube. The discharge current is fixed with the aid of a shunt with its inductance compensated up to frequencies of 1 to 1.2 megacycles through the amplifier of the oscillograph's first channel. The integral erosion of the electrodes, the value of the microroughness, the composition and the mass of the products of pyrolysis, etc., are then all determined by the serial method. A more detailed description of the equipment and some of the oscillograms obtained with this method are included. R.N.A.

N66-26154# Joint Publications Research Service, Washington, D. C.

THE MEDIA FOR ELECTRO-EROSION TREATMENT OF METALS

A. N. Merkur'yev, N. S. Pechuro, L. A. Royter, V. N. Gol'din, and O. Yu. Pesin *In its* Electron. Treat. of Mater. 2 May 1966 p 21–38 (See N66-26150 14-34) CFSTI: $4.00

This report examines the results of experimental investigations on the effect of the composition of certain organic and inorganic media on the process of erosion. The study showed that the electro-erosion process of making apertures in a medium composed of various organic compounds illustrates the effect of their physical and chemical properties on the output of the process of treatment. In making apertures, a maximum erosion is observed when aromatic compounds and polyethyl-silozanes are used as the media between the electrodes. In the cutting of metals, the use of aqueous solutions of electrolytes as media between the electrodes makes it possible to improve the cleanliness of the surface of the treated parts by the joint action of the electro-erosion and electrochemical processes. R.N.A.

N66-26155# Joint Publications Research Service, Washington, D. C.

ELECTRO-EROSION PRECISION TREATMENT OF METALS IN A MEDIUM CONTAINING NO CARBON

Ye. V. Kholodnov *In its* Electron. Treat. of Mater. 2 May 1966 p 39–50 refs (See N66-26150 14-34) CFSTI: $4.00

This paper investigates the electro-erosion precision treatment of metals in a carbon-free medium. It is shown that the use of distilled water as the inter-electrode medium for electrospark precision shaping of surfaces with an unshaped electrode wire is not only possible in principle, but also more economical. Compared with kerosene, it results in a higher output of parts of electronic devices and technological tools, reduces the labor spent for their cleaning, and improves working conditions of the attending personnel. By replacing kerosene with carbon-free water as the inter-electrode medium, the electrospark process operates under conditions favoring a more effective realization of power in the gap. As a result, the output of the process is two to three times higher when either a RC generator or a thyratron generator is used as the pulse source. With distilled water as the inter-electrode medium in operation for electrospark treatment, characterized by a better than the 7th class of surface cleanliness and requiring the use of electrode wires with diameters of less than 0.1 mm, the technological indicators of RC generators are better than those of thyratron generators. R.N.A.

N66-26156# Joint Publications Research Service, Washington, D. C.

ELECTROCHEMICAL METHOD OF GRINDING METAL-CERAMIC ALLOYS

Y. Stanek, Meng Siu Ing, Y. Zubak, and Y. Zhukha *In its* Electron. Treat. of Mater. 2 May 1966 p 51–53 (See N66-26150 14-34) CFSTI: $4.00

The advantages of the electrochemical method of grinding or sharpening tools with edges made of metal-ceramic alloys are discussed. The electrochemical grinding method can be used for shaping any complex surface, either external or internal. The method represents a cold process which thereby eliminates the possibility of defective layers on the treated surface. With a current density of 500 amp/cm^2, the process has an output of about 60 mm^3/min with 0.4 microns as the roughness of the treated surface. The precision of the treatment is ±0.03 mm. The wear of the untempered steel grinding disk does not exceed 0.1 mm along the radius after treating 20 parts. The production costs of the parts obtained by the electrochemical grinding method is 50% lower than the cost of the same parts ground by abrasives. R.N.A.

N66-26157# Joint Publications Research Service, Washington, D. C.

THE PLATING MECHANISM IN ELECTROSPARK ALLOYING OF SURFACES

N. I. Lazarenko *In its* Electron. Treat. of Mater. 2 May 1966 p 54–58 refs (See N66-26150 14-34) CFSTI: $4.00

This article describes the plating mechanism, involving the transfer of material from anode to cathode, which takes place in the electrospark alloying of metal surfaces. As a result of a single electrospark discharge, material is ejected from the anode, at points where the discharge channel is in contact with the surface of the electrode, forming on their surface a lune. The size of the lune depends on the resistance of the electrode's material against electrical erosion and on the energy of the electrical pulse. When electrical pulses act repeatedly on one point, a lune with strongly magnified dimensions forms. Thus, it is necessary that the alloying electrode be constantly moved along the treated surface to form a plated layer of good quality. Another factor affecting the alloying quality is the character of the impact with which the treating electrode comes in contact with the cathode. A strong abrupt impact of the electrode and its rapid motion backwards will transfer less metal than a soft impact on the treated surface. The transfer of metal depends on whether the anode is in

direct proximity with the cathode surface at the moment metal is ejected from the former, or whether the anode is at a distance from the cathode to allow enough time for cooling and oxidizing of the metal, which makes it impossible for the metal to combine with the cathode. R.N.A.

N66-26158# Joint Publications Research Service, Washington, D. C.
THE ELECTROSPARK METHOD OF IMPROVING THE DURABILITY OF THE CUTTING UNITS OF AGRICULTURAL MACHINES
Yu. N. Petrov, I. I. Safronov, and S. P. Fursov *In its* Electron. Treat. of Mater. 2 May 1966 p 59–61 (See N66-26150 14-34) CFSTI: $4.00

An investigation was conducted to determine if the electrospark alloying method could improve the wear resistance of the cutting components of agricultural machines. The study involved components of combines and reapers, and blades of ensilage cutters and grafting machines. Wear resistance was estimated under laboratory conditions by determining the microhardness of the plated layer on the cutting components, and from data obtained by field tests on the agricultural machines conducted under normal operating conditions. The comparative field tests showed that the durability of the cutting components hardened by the electrospark method is 5 to 6 times better than the durability of presently used cutting parts. R.N.A.

N66-26163# Joint Publications Research Service, Washington, D. C.
ELECTRICAL FLOTATION OF SUBSTANCES
B. M. Matov *In its* Electron. Treat. of Mater. 2 May 1966 p 92–95 ref (See N66-26150 14-34) CFSTI: $4.00

An electrical flotation method is described for separating solid particles from a liquid by floating hydrogen bubbles liberated by the electrolysis of water. The hydrogen bubbles collide with solid particles in the liquid, adhere to them, and carry them to the surface of the liquid in the form of a foam which can be easily removed. The equipment consists of a vessel with a metallic plate, a cathode located on its bottom, and a graphite anode located vertically above the cathode. A uniform saturation with hydrogen bubbles is obtained by having the plate cover the entire bottom of the vessel. Oxygen bubbles are also released by the electrolysis but they settle on the anode, slide upwards along the rod surfaces, and therefore, do not take any significant part in the flotation process. R.N.A.

N66-26164# Joint Publications Research Service, Washington, D. C.
ELECTROSPARK METHOD USING UNPROFILED ELECTRODES FOR MAKING PRECISION BLANKING DIES
V. P. Smolentsev *In its* Electron. Treat. of Mater. 2 May 1966 p 96–101 refs (See N66-26150 14-34) CFSTI: $4.00

This article discusses the results of investigations and the experience gained in using the electrospark process for producing precision hard alloy and steel blanking dies by an unprofiled electrode. Calculations and tests have shown that the treatment by an unprofiled electrode can produce a surface with the required cleanliness at an overall minimum cost for cutting out the contour of the die. A surface cleanliness of the 7–8th class is economically obtainable for hard alloys, and of the 6–7th class for steel. The high precision obtained by treating the operating parts with an unprofiled electrode makes it possible to employ dies operating step by step. This increases the stamping output, because the blanked parts are removed through the matrix without having to blow them out with compressed air. It also opens wide opportunities for automation of the process. R.N.A.

N66-26165# Joint Publications Research Service, Washington, D. C.
THE VUMA-VJK-4 ELECTROSPARK UNIT
In its Electron. Treat. of Mater. 2 May 1966 p 102–104 (See N66-26150 14-34) CFSTI: $4.00

This report describes the VUMA-VJK-4 electrospark unit which is designed for shaping outside and inside surfaces by copying directly the geometrical shapes of the treating electrode. It is designed for work in tool shops and for the production and repair of all types of dies, draw plates, and other metal blanking and metal pressing tools, including those made of carbide materials. Specifications of the unit are listed. R.N.A.

N66-26179# National Academy of Sciences—National Research Council, Washington, D. C. Materials Advisory Board
EVALUATION TEST METHODS FOR REFRACTORY METAL SHEET MATERIALS
Nov. 1965 43 p refs Supersedes MAB-192-M; See X63-12547
(Contract ARPA SD-118)
(MAB-216-M; MAB-192-M; AD-625606) CFSTI: HC $2.00/MF $0.50

This is the third revision of recommended test methods for refractory metal sheet published by the Materials Advisory Board Refractory Metals Sheet Rolling Panel. The Panel's objective was to provide a standard basis for the test evaluation of sheet materials produced under various Department of Defense development programs. A subpanel was appointed for this purpose. After a thorough canvas of prominent suppliers and users of refractory sheet metals, the first recommendations were published in September 1961 as MAB-176-M to define common tensile, creep-rupture, bend, and thermal properties tests. Subsequently, as the Department of Defense programs progressed, more specialized tests became necessary to evaluate fabrication characteristics and to provide preliminary design data. Again, after discussion with principal organizations engaged in direct applications, a revised edition was published April 22, 1963, as MAB-192-M. Since that time, criticisms and comments have been reviewed by the subpanel with qualified individuals representing governmental and commercial laboratories. The present edition is based upon these reviews. Changes have been made in the tests described in Sections 1 through 6. The tests in Sections 7 through 15 are unchanged from Report 192-M. In preparing these recommendations, the subpanel has deferred where possible to prominent ASTM standards. Author (TAB)

N66-26204# Atomic Energy Board, Pretoria (South Africa).
AN ELECTROLYTIC JET MACHINING METHOD FOR CUTTING SINGLE CRYSTAL AND POLYCRYSTALLINE URANIUM CARBIDE
H. N. J. Louw, R. J. Schmitt, and M. J. Sole Jun. 1965 9 p refs
(PEL-79)

A goniometer is used to position the specimen at the desired angle to the high-pressure knife-like jet of electrolyte. A large d-c voltage is applied between the specimen and the cathode, which is incorporated in the jet nozzle. The construction of the jet nozzle and the electrolyte pumping system is described and the composition of electrolyte used is given. NSA

N66-26226# California Univ., Livermore. Lawrence Radiation Lab.
MECHANICAL MOTION IN VACUUM
Thomas H. Batzer 15 Apr. 1964 24 p
(Contract W-7405-ENG-48)
(UCRL-7830) CFSTI: HC $1.00/MF $0.50

Mechanical motion in vacuum is described in terms of how it is achieved, its purpose, the effect of vacuum on the mechanism, and the effect of the mechanism on the vacuum. A vacuum environment permits certain processes to proceed that might otherwise be impracticable. Mechanical motion in vacuum processing is often needed. The seals and motion mechanisms, including lubrication, must not adversely affect the permissive vacuum environment. Conversely, in the case of very low pressure ($<10^{-9}$ torr) the motion mechanism needs protection from the vacuum. Based on these considerations, some current means and methods of providing mechanical motion in vacuum are discussed. Author (NSA)

N66-26230*# Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF WELDING TECHNIQUES AND FILLER METALS FOR HIGH STRENGTH ALUMINUM ALLOYS Annual Summary Report, 27 Jun. 1964–27 Jun. 1965
H. C. Burghard, Jr., N. G. Lenamond, A. L. Lowenberg, J. Mc Donald, Jr., E. B. Norris et al 11 Oct. 1965 155 p
(Contract NAS8-1529)
(NASA-CR-74992) CFSTI: HC $5.00/MF $1.00 CSCL 13H

The properties of MIG and TIG weldments of 2014-T6 and 2219-T87 aluminum alloys under biaxial and uniaxial loading conditions were measured and compared. The results of this study indicate that the TIG process is superior to the MIG process for the fabrication of 2014-T6. A number of observations were made which indicate that the membrane stress formula, derived for a spherical shell, is not adequate for the determination of the absolute value of biaxial ultimate strength from hydraulic bulge test data. A study of the natural aging characteristics of 0.187-inch thick MIG and TIG X7106 weldments, made with X5180, 5356 and 5556 filler metal alloys, was carried out. The hot cracking characteristics of X7106-T63 weldments relative to those of 2219-T87 were investigated. Of the six combinations of welding process and filler metal included in the study of X7106 weldments, the TIG weldments, as a group, exhibited higher uniaxial tensile properties than those of the MIG weldments. Only slight differences in mechanical properties among the weldments made with the three different filler alloys by one process were noted. Author

N66-26238*# General Electric Co., Cleveland, Ohio. Lamp Metals and Components Dept.
DEVELOPMENT OF FABRICATION PROCESS FOR METALLIC FIBERS OF REFRACTORY METAL ALLOYS Six Month Progress Report
L. H. Amra, L. F. Chamberlain, F. R. Adams, J. F. Tavernelli, and G. J. Polanka 20 Jan. 1966 99 p
(Contract NAS3-7906)
(NASA-CR-75015) CFSTI: HC $3.00/MF $0.75 CSCL 13H

The six refractory metal alloy systems under study are: TZC, AS-30, W–Re–ThO_2, W–Hf–C, FS-85, and T-222. The strength goal for these wires is a stress-to-density ratio of 125,000 inches for a rupture life of 3,000 hours in a temperature range of 2000° F to 2200° F. A small amount of TZC alloy wire at 5 mils diameter has been produced by working down vacuum cast ingots. The AS-30 alloy has been melted. Considerable difficulty has occurred in attempts to produce workable tungsten alloy bars from pressed and sintered powders, in both tungsten systems. However, recent efforts with the tungsten–rhenium–thoria system are very encouraging. The other part of the task contracted for, the designing and building of a six station creep, stress–rupture test equipment, has progressed to the building stage. Author

N66-26239*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
INSTRUCTION MANUAL FOR EPITAXIAL APPARATUS
Jack L. Halsor 30 Sep. 1965 74 p
(Contract NAS5-3758)
(NASA-CR-74954) CFSTI: HC $3.00/MF $0.75 CSCL 13H

An instruction manual is given for an apparatus which utilizes programmer operation of electronic valves for the etching and growth of single crystal silicon, deposition of silicon dioxide, silicon dioxide nucleation site treatment, and undoped silicon growth. The epitaxial deposition is accomplished by equipment composed of a gas control apparatus which controls the atmosphere of a reaction tube in which the epitaxial layers are deposited; an electronic programming device which operates the gas control apparatus valves through the desired cycles; and the reaction tube apparatus consisting of a quartz tube placed in an induction coil which heats the silicon substrates by means of a carbon susceptor. The reaction tube and gas control apparatus are in enclosures which permit air to be drawn through and exhausted through an exhaust system. C.T.C.

N66-26265*# Boeing Co., Seattle, Wash. Saturn Booster Branch.
AN ANALYSIS OF ETCHANT EFFECTS ON PENETRANT PERFORMANCE
Frank J. Musil [1965] 30 p
(Contract NAS8-5608)
(NASA-CR-75001; T5-6539-2) CFSTI: HC $2.00/MF $0.50 CSCL 13H

The necessity of etching welds prior to penetrant inspection was investigated. Crack-like fissures, observed in Y-ring base metal only after etching, were found to be due to the welding and not to etching. Manual etching methods, to prevent preferential grain boundary, were developed and are described. Penetrant inspection studies are reported. It was concluded that etching of burnished, shaved, and/or sanded welds is mandatory in order to assure adequate detection of discontinuities using penetrant methods, especially where tight cracks are present. N.E.N.

N66-26277*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MACHINING AND GRINDING OF ULTRAHIGH-STRENGTH STEELS AND STAINLESS STEEL ALLOYS
C. T. Olofson, J. A. Gurklis, and F. W. Boulger (Battelle Mem. Inst., Columbus, Ohio) Oct. 1965 229 p refs Prepared by Battelle Mem. Inst. under subcontract from Army Missile Command
(NASA Order H-76715; Contract DA-01-021-AMC-11061(Z)) (NASA-TM-X-53433; RSIC-501) CFSTI: HC $6.00/MF $1.25 CSCL 13H

This report covers the state of the art of metal-removal operations for stainless and ultrahigh-strength steels. It describes the methods currently employed for conventional machining, grinding, electrolytic, electric-discharge, and chemical-machining processes. The precautions that should be taken to avoid troubles resulting from the characteristics typical of these alloys are pointed out. Nine machining, two grinding, two cutting, and three unconventional metal-removal operations are discussed separately. Other sections discuss the classification of these alloys and their general response to machining variables. Author

N66-26278*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

DEFORMATION PROCESSING OF TITANIUM AND ITS ALLOYS

A. F. Gerds, D. E. Strohecker, T. G. Byrer, and F. W. Boulger (Battelle Mem. Inst., Columbus, Ohio) 18 Apr. 1966 361 p refs Prepared by Battelle Mem. Inst. under subcontract from Army Missile Command

(NASA Order H-76715; Contract DA-01-021-AMC-11651(Z)) (NASA-TM-X-53438; RSIC-420) CFSTI: HC $7.00/MF $2.00 CSCL 13H

This report covers the state of the art of both primary and secondary fabrication methods for titanium and its alloys and is oriented toward the interests of the designer and the manufacturing engineer. Methods currently employed for primary fabrication of titanium include rolling, extrusion, forging, and drawing of tube, rod, and wire. Secondary metalworking operations are those processes that produce finished parts from sheet, bar, or tubing using additional metalforming operations. The following secondary forming processes are discussed: brake bending, deep drawing, spinning and shear, drop hammer, trapped rubber, stretch, tube, roll, dimpling, joggling, and hot sizing. Equipment and tooling that are used for the various operations are discussed and illustrated wherever possible. Author

N66-26279*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

MECHANICAL FASTENING OF NICKEL-BASE ALLOYS

D. L. Cheever, R. E. Monroe, and D. C. Martin (Battelle Mem. Inst., Columbus, Ohio) 20 Apr. 1966 101 p refs Prepared by Battelle Mem. Inst. under subcontract from Army Missile Command

(NASA Order H-76715; Contract DA-01-021-AMC-11651(Z)) (NASA-TM-X-53441; RSIC-609) CFSTI: HC $4.00/MF $0.75 CSCL 13H

This report covers the state of the art of mechanical fastening of nickel-base alloys. The designing, forming, machining, assembling, and inspection of nickel-base joints are described in detail when the processes used are known to differ markedly from those processes used for common steel, aluminum, and copper alloys. Author

N66-26280*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

MACHINING AND GRINDING OF NICKEL-BASE AND COBALT-BASE ALLOYS

C. T. Olofson, J. A. Gurklis, and F. W. Boulger (Battelle Mem. Inst., Columbus, Ohio) 20 Apr. 1966 157 p refs Prepared by Battelle Mem. Inst. under subcontract from Army Missile Command

(NASA Order H-76715; Contract DA-01-021-AMC-11651(Z)) (NASA-TM-X-53446; RSIC-482) CFSTI: HC $5.00/MF $1.00 CSCL 13H

This report covers the state of the art of metal-removal operations for nickel- and cobalt-base alloys. It describes the methods currently employed for conventional machining, grinding, electrolytic, and chemical-machining processes. The precautions that should be taken to avoid troubles resulting from the characteristics typical of these alloys are pointed out. Nine machining, two grinding, two cutting, and two unconventional metal-removal operations are discussed separately. Other sections discuss the classification of these alloys and their general response to machining variables. Author

N66-26281*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

JOINING OF NICKEL AND NICKEL-BASE ALLOYS

J. J. Vagi, R. E. Monroe, R. M. Evans, and D. C. Martin (Battelle Mem. Inst., Columbus, Ohio) 20 Apr. 1966 167 p refs Prepared by Battelle Mem. Inst. under subcontract from Army Missile Command

(NASA Order H-76715; Contract DA-01-021-AMC-11651(Z)) (NASA-TM-X-53447; RSIC-484) CFSTI: HC $5.00/MF $1.00 CSCL 13H

The state of the art of the joining of nickel and nickel-base alloys that contain at least 50 percent nickel is reviewed. This report covers joining by welding, brazing, and soldering. Joining preparations, specific joining processes, joining dissimilar metals, and joint quality are discussed. Author

N66-26344# Sperry Rand Corp., Gainesville, Fla. Sperry Electronic Tube Div.

INVESTIGATION OF BRAZING TECHNIQUES FOR FERRIMAGNETIC MATERIALS Final Report, 15 Jun.–15 Dec. 1965

Robert W. Buck, John M. White, and Louis A. Tentarelli Jan. 1966 77 p

(Contract DA-28-043-AMC-00373(E)) (SETD-NJ-2769-0202-5; AD-630700)

The following two vapor deposition metalizing techniques were developed for metalizing ferrimagnetic materials: (1) evaporating approximately 6000 Å of iron, (2) sputtering approximately 5000 Å of nickel. It was advantageous to electrodeposit about 0.0001 inch nickel on the vapor deposited films. Nickel ferrite and yttrium iron garnet toroids were fabricated and brazed to Kovar, copper and titanium mating members using a vacuum brazing furnace equipped with an induction coil. The parts to be brazed were placed inside a boxlike nickel container which, in turn, was placed in the induction coil. Incusil 15 and copper–silver eutectic braze alloys were used. Relatively strain-free brazes were made between ferrimagnetic materials and both copper and titanium. Strain could not be eliminated when brazing to Kovar. No significant changes in either saturation magnetism or linewidth as a result of the brazing operation were observed. An increase in dielectric loss tangent was observed when nickel ferrite was metalized with evaporated iron. No changes in dielectric loss tangent were observed when sputtered nickel films were used as metalizing. Author (TAB)

N66-26362# Army Materials Research Agency, Watertown, Mass. Materials Technology Div.

A REPORT GUIDE TO ULTRASONIC TESTING LITERATURE, VOLUME I

Charles P. Merhib and Ernest H. Rodgers Mar. 1966 137 p refs

(AMRA-MS-66-02; AD-630652) CFSTI: HC $4.00/MF $1.00

The main objective of this compilation is to provide a simple and fast access to information on the subject of ultrasonic tesing and also to provide sufficient information in the form of abstracts and word descriptors to make the listing useful. This guide is Volume I of a series of planned report guides consisting of the complete coverage of items in the AMRA Nondestructive Testing Information Analysis Center covering the subject of ultrasonic testing exclusive of those items in the Center utilizing methods of ultrasonic attenuation. TAB

N66-26372# General Electric Co., Schenectady, N. Y. Research Lab.
AN INVESTIGATION OF STRUCTURAL DAMAGE IN METAL-FORMING PROCESSES Final Report, 18 Jun. 1963-18 May 1964
H. C. Rogers, R. C. Leech, and L. F. Coffin, Jr. Jul. 1964 51 p refs
(Contract NOw-63-0671-c)
(AD-603404) CFSTI: HC $3.00/MF $0.75

A study of structural damage in the sheet-drawing of OFHC copper, tough-pitch copper, and aluminum alloy 6061-T6 was undertaken in an attempt to investigate the role of the stress state occurring during the deformation to the concomitant changes in the microstructure that would influence the resultant mechanical properties. Because of its completeness, the Hill-Tupper slip-line field solution for sheet-drawing was employed, and experimental drawing experiments were conducted matching as closely as possible the assumptions of the theory regarding plane strain, constancy of yield stress, and die geometry. Calculations showed that for light reductions at various die angles, marked gradients in the hydrostatic component of stress developed in the deformation zone, ranging from tension as high as 0.7 of the yield stress along the center line to compressions 2.5 times the yield stress at the surface. Structural damage, as assessed by microscopic examination, and density changes on drawn sheet revealed that central plane void formation developed in those cases where high hydrostatic tensions were produced in the deformation zone under conditions of repeated drawing. Author (TAB)

N66-26401# ACF Industries, Inc., Albuquerque, N. Mex.
FILAMENT WOUND JOINT DESIGN STUDY
W. F. Underwood 13 Oct. 1965 100 p
(Contract AT(29-1)-1352)
(ACF-412-256; ACF-15) CFSTI: HC $3.00/MF $0.75

Studies were made to establish the type of joints in filament wound structures which made the most effective contribution to joint strength and integrity. The problem of bonding dissimilar materials, such as fiberglass to metal, was investigated. Basic data concerning bond strengths, cleaning procedures for bonding, ultimate laminate shear and bearing stresses, and various joint concepts are presented.
Author (NSA)

N66-26439# Army Weapons Command, Rock Island, Ill. Research and Engineering Div.
EVALUATION OF CUTTING FLUID APPLICATION METHODS
Lanny D. Wells Feb. 1966 16 p refs
(RIA-66-734; AD-629918) CFSTI: HC $1.00/MF $0.50

An investigation of the effects of different cutting fluid application methods has been conducted. Conventional flood application was compared with mist application from three different mist units. Under most conditions flood application resulted in slightly better performance. However, different water soluble cutting fluids and different fluid concentrations had a greater effect on performance than the application method.
Author (TAB)

N66-26449# Mechanical Technology, Inc., Latham, N. Y.
EXPERIMENTS ON AN ULTRA-STABLE GAS JOURNAL BEARING
S. B. Malanoski Nov. 1965 36 p refs
(Contracts AT(30-1)-3363; Nonr-3730(00))
(MTI-65TR37; TID-22528) CFSTI: HC $2.00/MF $0.50

Shallow grooving in a herringbone pattern has been proposed to enhance the stability of both gas and liquid lubricated journal bearings. It has been shown theoretically that this possibility is particularly advantageous for unloaded journal bearings. Corroborating experiments are described. The experiments included the running of an unloaded bearing up to speeds of 60,000 rpm and the collection of steady state load-displacement attitude angle data at intermediate speeds up to and including 60,000 rpm. No sign of bearing whirl instability was detected. There was good correlation between theoretical and experimental data. Design data are included as a guide for future designs. Author (NSA)

N66-26461# Ceskoslovenska Akademie Ved. Rez. Ustav Jaderneho Vyzkumu.
THE PRECISE SYNCHRONIZATION, THE MEASUREMENT OF THE SPATIAL ANGLE, AND THE CIRCULAR DIAGRAM OF REACTIONARY SYNCHRONOUS MOTORS [PRESNA SYNCHRONIZACE MERENI PROSTOROVEHO UALU A KRUHOVY DIAGRAM REAKCNICH SYNCHRONNICH MOTORU]
V. Plasil 1965 72 p refs In CZECHOSLOVAKIAN
(UJV-1388/65)

An analysis is presented of the precise synchronization of two motors with the aid of a transmission. At the conditions considered, a mean deviation of the spatial angle of ±3.5 angular minutes was attained. An analysis of the measurement of the spatial (load) angle of a motor by means of current phase is also included. With suitable retarding compensation, the relative error is not greater than 5%. A derivation of a circular diagram of an actual motor is given with an examination of the losses in the copper, the iron, and dissipation. A method of directly deducing the performance and loss from a circular diagram is outlined. By means of collinearity, the construction of an angular scale for the spatial angle on a circular diagram is derived. NSA

N66-26473# Roentgen Technische Dienst N. V., Rotterdam (Netherlands).
NON-DESTRUCTIVE WELD STUDIES Quarterly Report No. 17, 1 Jul.-30 Sep. 1965
18 Nov. 1965 53 p Transl. into ENGLISH from Dutch
(Contract EURATOM-045-61-5 RDH)
(EURAEC-1519; EUR-2671) CFSTI: HC $3.00/MF $0.50

A recording system for ultrasonic data was evaluated. Dynamic screen images were used that contained the Z-axis as an added dimension. Movement of the probe perpendicular to the weld produced motion in the Y-axis of the oscilloscope. In addition, a flaw echo recording pen was used whereby the same probe movement controlled the position of a moving gate, which limited the path length to cover the weld only. The effects of the composition and thickness of screens on the image quality of radiographs produced by a ^{60}Co source and a 5 Mev linear accelerator was studied. Screens of Cu, Pb, Ag, Sn, and Ta with thickness of 0.25 to 2.5 mm were evaluated. For the radiographs made with the 5 Mev linear accelerator, neither the screen thickness nor composition had an appreciable influence on the image quality. Radiographs made with the ^{60}Co source and Cu screens had the best image quality. The image quality was not controlled by the thickness of the Cu screens. The thickness of Pb or Ta screens did influence the image quality; a thickness of 1.5 mm gave the best results. NSA

N66-26497# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POWDER METAL MATERIALS FOR MANUFACTURING LARGE-SCALE PARTS IN MACHINE-BUILDING AND CONSTRUCTION
A. P. Motulevich 20 Jan. 1966 5 p Transl. into ENGLISH from Russian Patent no. 161125 (Appl. no. 841667/22-2, 11 Jun. 1963) 1 p
(FTD-TT-65-1390/1+4; AD-629413) CFSTI: HC $1.10/MF $0.50

The proposed powder metal materials consist of metals (e.g., steel, cast iron, aluminum, titanium) and a ceramic component (basalt, granite, spinel, corundum), which is introduced into the metal in the process of its fusion and has a heat resistance not lower than the temperature of fusion of the given metal. The application of such materials for manufacturing large-scale parts in a machine-building and construction permits attaining a significant economy of the metal while preserving its compressive strength, heat resistance and resistance to corrosion. The parts can be manufactured by the known technological methods of casting, machining and welding. Author (TAB)

N66-26576# Southwest Research Inst., San Antonio, Tex. Dept. of Aerospace Propulsion Research.
RESEARCH ON MITIGATION OF SPLINE WEAR BY MEANS OF LUBRICATION Quarterly Progress Report No. 3, 15 Nov. 1965–15 Feb. 1966
W. D. Weatherford, Jr., M. L. Valtierra, and P. M. Ku 15 Feb. 1966 27 p refs
(Contract NOw-65-0224-f)
(RS-485; AD-639938) CFSTI: HC $2.60/MF $0.50

Experiments were made to investigate the effect of hydrocarbon antioxidants on the spline wear observed when operating submerged in mineral oil. The results indicate that certain hydrocarbon antioxidants provide periods of negligible wear which otherwise do not occur in air-saturated mineral oil. The observed antioxidant effect and previously reported influences of environment composition are tentatively interpreted in terms of postulated wear mechanisms.
Author (TAB)

N66-26578# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.
MICROWAVE INSPECTION TECHNIQUES FOR DETERMINING ABLATIVE SHIELD THICKNESS AND CERAMIC MATERIALS PROPERTIES
Rudolph V. Giangrande Dec. 1965 21 p refs
(AMRA-TR-65-31; AD-629908) CFSTI: HC $1.00/MF $0.50

The report presents an application of microwave technology as applied to material evaluation. A reflectometry system for the measurement of ablative shield thickness is described and experimental procedures and results examined. A method of transmission loss measurements for the evaluation of several ceramic materials is included and experimental procedures and results discussed. Author (TAB)

N66-26654*# IIT Research Inst., Chicago, Ill. Technology Center.
ENVIRONMENTAL STUDY OF MINIATURE SLIP RINGS Quarterly Report No. 11, 1 Jan.–1 Apr. 1966
O. M. Kuritza [1966] 15 p
(Contract NAS8-5251)
(NASA-CR-75119; E6000-32) CFSTI: HC $1.00/MF $0.50 CSCL 13H

Work was begun on a sublimation technique to lubricate slip rings in a high vacuum. A run-in test of a hard gold overlay was conducted in a nitrogen atmosphere; and sufficient debris was collected to perform a qualitative spectrographic analysis for determination of organic constituents. In an attempt to improve noise performance, the brush was redesigned; no substantial improvement was obtained, however. Nickel-soft gold plated rings were prepared for testing in a nitrogen atmosphere; and preparations were completed for testing in a high vacuum using an ion pump. D.T.

N66-26696*# Republic Aviation Corp., Farmingdale, N. Y.
DESIGN, DEVELOPMENT, MANUFACTURE, AND DELIVER NEW CONCEPTS FOR HIGH ENERGY RATE FORMING SYSTEM Quarterly Report No. 3
Basil Leftheris Apr. 1965 24 p
(Contract NAS8-11811)
(NASA-CR-75032; RAC-2788-2) CFSTI: HC $1.00/MF $0.50 CSCL 13H

In the construction of large transducers, the conversion of electrical energy to potential energy through the driver plate was considered, as well as the conversion of potential energy in the pressure wave to strain energy in the workpiece. Two 28-inch domes were formed using a 12-inch pancake coil Electromagnetic Transducer (EMT); and for comparison, a 28-inch dome was formed using an electron beam welding technique. The EMT was mechanized by resetting the driver plate with two air cylinders. It is reported that this advanced the EMT method considerably. Theoretical calculations of the loading side of the pressure wave were found to be 16% higher than the experimental values obtained. An analysis of this finding is included. H.S.W.

N66-26703*# Republic Aviation Div., Fairchild Hiller Corp., Farmingdale, N. Y.
DEVELOPMENT OF TOOLING, PRODUCTION PROCEDURES, AND PRODUCTION OF 57-INCH BULKHEADS Final Report, Jul. 1964–Dec. 1965
Gunther Pfanner [1965] 99 p
(Contract NAS8-11500)
(NASA-CR-75066; FHR-3232) CFSTI: HC $3.00/MF $0.75 CSCL 13H

Thin 57-inch ellipsoid bulkheads were fabricated in 2219-T6 aluminum alloy for welding into liquid oxygen test tanks. A sequence of fabrication operations involving hydraulic forming, selective chemical milling, heat treatment and contour sizing was developed to obtain close diameter and thickness dimension ranges. The principal development aspects were involved with obtaining forming control of the draw/stretch ratio to avoid buckling or splitting failures. These factors constitute a problem area in aluminum alloys at the high diameter ratio (715:1) of the 57-inch bulkhead blanks. Experimental difficulties were satisfactorily resolved, and a general method of forming control which follows empirical and analytical relationship was evolved. Specific accomplishments include the development of: (1) a segmented pressurized metal bladder for localized control of the workpiece flange, (2) an optimized stretch-draw (or depth-draw) relationship, (3) an inexpensive reinforced fiberglass die concept, (4) a unique hinged flange and pressurization design, and (5) an expandable seal against the moving workpiece surface. Author

N66-26771# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON GENERAL MACHINE DESIGN AND CONSTRUCTION [LITERATUUROVERZICHT ALGEMENE WERKTUIGBOUW]

25 Apr. 1966 23 p refs In DUTCH, ENGLISH, and GERMAN *Its* Vol. 4, No. AW-33
CFSTI: HC $1.00/MF $0.50

Abstracts and bibliographic notes are presented on the topics of diesel engines, gas and steam turbines, steam installations, tools, machine parts and lubrication, materials, and measurement and regulation techniques. Transl. by J.O.

N66-26777# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON MILITARY MEDICINE [LITERATUUROVERZICHT MILITAIRE GENEESKUNDE]
15 Mar. 1966 31 p refs In DUTCH, ENGLISH, GERMAN, and FRENCH *Its* Vol. 12, No. G-128 CFSTI: HC $2.00/MF $0.50

Abstracts and bibliographic notes are presented on the topics of chemical-biological-radiological dangers, air force medicine, psychology and psychiatry, internal medicine, surgery, the medical aspects of sea diving, pharmacology and toxicology, sensory physiology, and biomechanics. Transl. by J.O.

N66-26792# Battelle-Northwest, Richland, Wash.
A HIGH-TEMPERATURE CREEP MACHINE FOR IN-CELL OPERATION
D. H. Nyman, M. R. Keegan (Atomic Energy Comm., Richland, Wash.), and J. A. Williams Sep. 1965 15 p refs
(Contract AT(45-1)-1830)
(BNWL-137) CFSTI: HC $1.00/MF $0.50

A high temperature creep machine capable of conducting creep and stress-rupture tests to 1300°C by remote operation was developed. Evaluation tests demonstrated that the apparatus meets the requirements of ASTM Recommended Practice E 139-58T. Author (NSA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N66-25513# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTICAL COMMUNICATIONS EMPLOYING SEMICONDUCTOR LASERS Technical Report No. 392
Edward J. Chatterton 9 Jun. 1965 73 p refs
(Contract AF 19(628)-500)
(ESD-TDR-65-232; AD-630243) CFSTI: HC $3.00/MF $0.75

This report discusses the development of optical communications employing semiconductor lasers—both noncoherent and coherent. The large modulation bandwidth obtainable with these devices permits the development of frequency- and pulse-modulation communications systems which overcome scintillation noise produced by the turbulent atmosphere. Emphasis has been placed on the development of communications systems for 98-percent weather capability over short ranges, rather than fairweather capability over long ranges. The development of supporting technology is presented in the areas of semiconductor lasers, fiber optics, optical systems, narrowband optical filters, photomultipliers, and frequency- and pulse-modulation electron circuitry and components. Measurements of optical signals over a two-mile path under a full variety of weather conditions have permitted a comparative evaluation of AM, FM, and PM systems. The results show clearly the advantage of frequency modulation and pulse modulation. Measurements of pulses transmitted appreciably beyond the limits of visibility in snow and fog indicate a channel bandwidth, limited by scatter-multipaths, but of the order of 200 Mcps. An analysis is presented of multiple-scatter paths and system design considerations for these conditions. Author (TAB)

N66-25778# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.
EFFECTS OF GAMMA-IRRADIATION ON THE CHARACTERISTICS OF A RUBY LASER
Vern R. Johnson and Richard W. Grow Sep. 1964 142 p refs
(Grants NSF G-15017; NSF GP-843)
(NSF-7)

Gamma radiation produces an increase in the absorption cross section responsible for optical pumping of a ruby laser, and threshold energy for laser action increases in relation to the amount of γ-radiation. After 20 minutes irradiation, threshold increased 27%; after 30 minutes, threshold is 35% higher than the unirradiated level. Following single crystal ruby irradiation with Co^{60} γ-rays, the four distinct absorption bands which exist between 200 and 500 mμ become one continuous band which includes all the wavelengths. Thermoluminescence data are presented which indicate that electron traps are formed in ruby as a result of irradiation; and two traps, whose activation energies are about 0.64 and 0.78 eV, remain in the crystal until it is annealed to about 800° C. Research on sapphire, the host crystal for ruby, indicates that the majority of increased absorption is by the Cr^{+++} ion in ruby, and a model is devised to explain what happens to these ions and how laser action is affected. M.W.R.

N66-25900# Air Force Systems Command, Kirtland AFB, N. Mex. Air Force Weapons Lab.
INVESTIGATION OF A LASER TRIGGERED SPARK GAP Technical Report, Jan. 1964–Dec. 1965
Winston K. Pendleton (Air Force Inst. of Tech.) and Arthur H. Guenther Mar. 1966 27 p refs
(AFWL-TR-65-32; AD-629905) CFSTI: HC $2.00/MF $0.50

The influence of parameters affecting the laser triggering of a high-voltage electrical sphere-sphere gap has been experimentally investigated. Of primary interest was the delay time between arrival of the laser pulse and current flow across the gap. This delay was studied as a function of total laser beam power (0–80 MW); dielectric gas (SF_6, N_2, air); gas pressure (100–1400 Torr) electrode spacing (0.4–1.5 cm); gap electric field (10–100kV/cm); and focus point location between two 5 cm diam stainless steel spheres. Delay times less than 10 nsec were observed in SF_6 at atmospheric pressure with corresponding low jitter. For the cases studied delay times varied inversely with the electric field, gas pressure, and focus point distance from the anode surface. Above a certain laser beam power the delay time was not a significant function of laser power for the range studied. Applications of laser triggering are discussed with a description of current and future research areas. Author (TAB)

N66-26252*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
PHOTOGRAPHIC MEASUREMENTS OF THE ENERGY DISTRIBUTION IN THE BEAM OF A RUBY LASER
C. G. Lehr, L. A. Maestro, and P. H. Anderson 25 Mar. 1966 22 p refs
(Grant NsG-87-60)
(NASA-CR-75102; SAO Special Rept.-205) CFSTI: HC $1.00/MF $0.50 CSCL 20E

The beam of a Q-switched ruby laser was directed toward a diffusely reflecting target at a distance of about 1/2 mile. The image on the target was photographed with a hand camera and the resulting films were measured with a microdensitometer. Two stop-openings were used for the photographs. The films exposed with the smaller stop-opening showed concentrations of energy with intensities up to 700 times the background energy. These concentrations are probably representative of the actual laser beam but they could be diffraction effects caused by irregularities in the surface of the diffuse target. The films exposed with the larger stop-opening were used to measure this background energy. Its average value was about half the nominal value of the energy determined from calorimetric measurements. This factor of one-half may be the combined effect of several losses that were neglected in the photometric measurements. The angular divergence of the beam was also measured. Author

N66-26512# Columbia Univ., New York. Plasma Lab.
OPTICAL AND ELECTRON INTERACTIONS WITH METASTABLES
Bertram Pariser [1965] 110 p refs
(Contract Nonr-266(93); Proj. Defender)
(Rept.-24; AD-627363) CFSTI: HC $4.00/MF $0.75

Afterglow plasmas are optically pumped with broadband radiation produced by a xenon flash lamp. The neon metastable concentration is decreased to less than 50 percent during the pumping, and a net depopulation results at the conclusion of the flash. A depopulation of the helium metastable is seen only during the pumping flash. By optically pumping neon metastables to the lower laser level, the laser lines (6328 Å and 1.15 microns) are quenched. Amplifications of the 1.15 micron laser line is observed when the population of the upper laser level is increased by selectively pumping neon metastables. Metastable collisions with heated electrons also result in a depopulation of the neon concentration. With further heating, the electrons gain enough energy to increase the metastable population by colliding with neutral neon atoms. Biondi's theory on ionizing collisions is examined while controlling the metastable population with optical pumping. The experimental data support the theory that metastable collisions are an important ionization process in an afterglow. Author (TAB)

N66-26570# Illinois Univ., Urbana. Gaseous Electronics Lab.
SPECTROSCOPIC AND MICROWAVE INVESTIGATION OF LASERING PLASMAS Scientific Report No. 4
L. A. C. Weaver and L. Goldstein Feb. 1966 177 p refs
(Contract AF 19(628)-3307)
(AFCRL-66-89; AD-629925) CFSTI: HC $5.00/MF $1.00

The relationship between the process of lasering, the electron gas, and the excited state populations of the active medium are studied for the noble gas lasers. Microwave signals are employed to perturb the electron gas, and resultant alteration of laser output is investigated. The effects of lasering upon the microwave propagation constant, noise radiation temperature, discharge current and spectral emission are investigated experimentally in He-Ne gas lasers, and radiative cascade patterns in noble gases are described by an idealized theoretical model. TAB

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N66-25391# Institut Franco-Allemand de Recherches, St. Louis (France).
STRENGTHENING OF ARMOR PLATES BY THE STRIKING OF STRONG, LEVEL SHOCK WAVES [VERFESTIGUNG VON PANZERPLATTEN DURCH SEHR STARKE, EBEN AUFTREFFENDE STOSSWELLEN]
H. G. Otto and C. Jessen 27 Jul. 1964 44 p refs In GERMAN
(Contract T-357-I-206)
(ISL-T-24/64) CFSTI: HC $2.00/MF $0.50

The increase of the pressure range from a previously applied 130 kbar to 500 kbar in the impact hardening of tempered armor plate 30 NiCrMo 16 is reported; only a slight increase in strength was noted. Earlier findings are confirmed that explosive impact hardening is effective only for metals with a wide strengthening range, such as Hadfield steel and Carbax iron. Feasibility of shock hardening in the field of steel alloying and steel treatment is discussed. Transl. by K.W.

N66-25409# India. Dept. of Atomic Energy, Bombay.
SELF DIFFUSION IN METALS
S. P. Murarka and R. P. Agarwala 1965 14 p refs
(AEET-233) CFSTI: HC $1.00/MF $0.50

An expression was derived for self and impurity diffusion in metals. The derivation was based on: (1) the occurrence of a local disorder or melting resulting in slippage, and (2) the fact that a total number of n atoms is involved in the diffusion of an atom from one position to a neighboring position in the lattice. Thus, it is pointed out, the local melting of n atoms before diffusion is necessitated, and the amount of energy needed for this melting can be identified with the activation energy. Therefore, if S is the average atomic heat between absolute zero and the melting temperature T_m° K, and L_f the latent heat of fusion; then $Q = n[(ST_m) + L_f]$, where Q is the activation energy. Finally, it is noted, the values for activation energy calculated from this equation are found to be in excellent agreement with the experimental results for face and body centered cubic metals. D.T.

N66-25426# Technische Hogeschool, Eindhoven (Netherlands).
REACTION DIFFUSION IN THE NICKEL–ALUMINUM SYSTEM [REACTIEDIFFUSIE IN HET SYSTEEM NIKKEL–ALUMINIUM]
Martinus Maria Petrus Janssen (Ph.D. Thesis) [1966] 134 p refs In DUTCH; ENGLISH summary CFSTI: HC $4.00/MF $1.00

This thesis describes an investigation of the formation by diffusion of the phases that exist in the nickel–aluminum system. For the investigation a diffusion-couple technique was used in which sheets of the pure metals and/or sheets of the intermetallic compounds were brought into contact with each other. After a diffusion experiment the new-formed phases appear in parallel layers in these diffusion couples. The layer formation of the $NiAl_3(\beta)$-phase was investigated at 610° C in Ni_2Al_3–Al couples. The $Ni_2Al_3(\gamma)$-phase forms in Ni–Al as well as Ni_3Al–Al and NiAl–Al couples; temperatures were taken between 400° C and 610° C. The NiAl(δ)-phase and the $Ni_3Al(\epsilon)$-phase form in measurable layer thicknesses in Ni_2Al_3–Ni and in NiAl(50/50)–Ni couples at temperatures between 600° C and 1000° C. The growth of the layers of the solid solution of aluminum in nickel (η-phase) was studied at Ni_3Al–Ni couples at temperatures of 800° C and 1,000° C. Author

N66-25439# European Atomic Energy Community, Brussels (Belgium). Metallurgy and Ceramics Service.
DEFORMATION MECHANISMS IN HEXAGONAL COMPACT METALS [MECANISMES DE DEFORMATION DES METAUX A STRUCTURE HEXAGONALE COMPACTE]
P. Guyot Dec. 1965 38 p refs In FRENCH; ENGLISH summary
(EUR-2621.f) CFSTI: HC $2.00/MF $0.50

A review of our knowledge on the deformation mechanisms in the h.c.p. metals is given. The basal glide, controlled by the cutting of the forest of dislocations c is only well understood; the prismatic glide seems to be determined by the cross slip of basal screw dislocations. The climb of dislocations as well as twinning and basal easy glide are also considered. Author

N66-25461# Philips Gloeilampenfabrieken N. V., Eindhoven (Netherlands).
MAGNETIZATION CURVES AND RESISTANCE TRANSITIONS OF SUPERCONDUCTING LEAD ALLOYS
W. F. Druyvesteyn (Ph.D. Thesis, Findhoven Tech. Univ., Jul. 1965) 1966 124 p refs *Its* Res. Rept. Suppl. No. 2
CFSTI: HC $4.00/MF $1.00

The magnetization curves and the resistance transitions of superconducting lead and lead alloys are discussed. Special attention is paid to the influence of foreign atoms or lattice defects. Some specific properties of hard and soft superconductors are briefly discussed. The experiments performed are described and commented upon. The magnetization curves of lead alloys in a longitudinal and transverse field are examined. The difference between the magnetization curves in a longitudinal and in a transverse field can be described with a model involving flux pinning, essentially depending on deviations from lattice regularity. The influence of a transport current on the magnetization is discussed; and the influence of lattice imperfections on the resistance transition of lead is dealt with. The extent to which lattice defects influence the resistance transitions is not yet entirely clear. Author

N66-25517# Marine Engineering Lab., Annapolis, Md.
EFFECT OF TEMPERING ON THE STRENGTH, HARDNESS, AND NOTCH TOUGHNESS OF HY-130/150, 5Ni-Cr-Mo-V STEEL
W. H. Asche and M. R. Gross Mar. 1966 22 p
(MEL-72/66; AD-630464) CFSTI: HC $1.00/MF $0.50

The effect of tempering in the range of 900° to 1150°F on the tensile properties, hardness, and Charpy V-notch toughness of HY-130/150, 5Ni-Cr-Mo-V steel was investigated. The investigation confirmed high tempering resistance claimed for the steel. The strength and hardness properties were found to be similar over a tempering range of 900° to 1050°F. The notch toughness, however, increased with increasing tempering temperature. Author (TAB)

N66-25556*# General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation.
MEASUREMENT OF THE PERMEABILITY OF TUNGSTEN TO HYDROGEN AND TO OXYGEN Final Report
E. A. Aitken, P. K. Conn, E. C. Duderstadt, and R. E. Fryxell May 1966 53 p refs
(Contract NAS3-6216)
(NASA-CR-54918) CFSTI: HC $3.00/MF $0.50 CSCL 11F

Permeation rates of hydrogen through arc-cast tungsten were measured at temperatures from 1300° to 2600°C with hydrogen pressure differentials of 1 and 0.1 atmospheres across isothermal membranes. Rates were nearly proportional to square root of pressure, were inversely proportional to membrane thickness, and had an activation energy of 33 kcal/mole. Permeation rates of oxygen through tungsten were studied in the temperature range 2000° to 2600°C. Sealed tungsten capsules containing known quantities of tungsten oxide were tested in helium and hydrogen, then broken open and the remaining oxygen assayed. Permeation coefficients obtained in this manner had a temperature dependency in the range of 40 to 45 kcal/mole. Author

N66-25588# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.
THE CRYSTALLOGRAPHIC MECHANISM OF PHASE TRANSFORMATIONS IN THIN METAL FOILS
H. Koritke and W. Pitsch 1965 20 p refs Transl. into ENGLISH from Acta Met., v. 12, Apr. 1964 p 417–429
(TRG-476(W)) HMSO: 3s

Crystallographic properties of phase changes in thin foils were measured in the electron microscope on an electrically heated specimen holder. The following phase changes were investigated: the precipitation of cementite $(Fe,Mn)_3C$ (Z) from austenite (A) and the precipitation of the iron nitride Fe_8N (n) and Fe_4N (N) from the ferrite (F). In the thin foils used in the experiments the preferred growth directions of the new phase are directions from the planes with the normals 1. $<1\bar{1}0\ 0\ 1>_Z$, 2. $<100>_n$, and 3. $<112>_N$. In cementite the internal structure consists of a fibrous structure along $\{010\}_Z$, and in the nitride Fe_4N it consists of a lamellar structure along the planes $\{111\}_N$. The nitride Fe_8N does not have a special internal structure. The present results are compared with corresponding results obtained on compact specimens. This comparison is also extended to other phase changes discussed in the literature. Obviously the crystallographic mechanism of phase changes in the specimens used is as a rule similar to the phenomena in compact materials. Author

N66-25598# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
THE EFFECTS OF NICKEL ON THE STRUCTURE OF SINTERED URANIUM CARBIDE
B. L. Eyre and A. F. Bartlett Nov. 1965 18 p refs
(AERE-R-5079)

Transmission electron microscopy has been used to study the effects of nickel on the structure of argon sintered uranium carbide. The results are compared with optical microscope observations, and electron probe micro-analysis measurements. U_2C_3 has been identified directly by electron diffraction in specimens containing no nickel, and 0.1 w/o nickel. There does not appear to be any particular orientation relationship between the UC matrix, and U_2C_3. Electron diffraction results from a second phase present in the UC–0.5 w/o nickel specimens were consistent with it being UNi_2. The most easily observable effect of nickel on the structure of UC was the formation of bands containing periodic fringe contrast. The bands lay on ~100 planes, and their behavior was consistent with a displacement vector of $1/2<113>$. It is shown that these results are consistent with the bands being thin plates of $UNiC_2$, formed from the UC lattice by a heterogeneous shear transformation. Author

N66-25599# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
HIGH TEMPERATURE PHASE EQUILIBRIA IN THE Th–U–C SYSTEM IN THE PRESENCE OF FREE CARBON
J. Henney and J. W. S. Jones Dec. 1965 19 p refs
(AERE-R-5093)

A study of the Th–U–C system has been carried out in the presence of about 1 w/o free carbon. It has been shown that extensive solid solutions are formed between ThC_2 and UC_2. At 1050° C ThC_2 can dissolve up to 57 w/o UC_2, and UC_2 can dissolve up to 30 w/o ThC_2. At temperature above 1820° C UC_2 changes from a tetragonal to a cubic structure, and at temperatures higher than about 1490° ThC_2 changes to a cubic structure. In the case of ThC_2 the change from monoclinic to cubic takes place via a tetragonal phase which exists from 1410° C to 1490° C. In the region where ThC_2 and UC_2 are cubic there is complete solid solubility. The phase boundary separating the cubic solid solution from the lower temperature forms extends from 1820° C for UC_2, through a minimum at 1150° C and a composition 40:60 w/o (Th U)C_2 to 1490° C for ThC_2. At temperatures below about 1700° C the (U Th)C_2 solid solution does not extend to the U–C boundary because of the formation of U_2C_3, and at 1500° C U_2C_3 is in equilibrium with a (U Th)C_2 solid solution containing 3–4 w/o ThC_2. Author

N66-25622# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

INTERSTITIAL DIFFUSION OF COPPER AND SILVER IN LEAD

B. F. Dyson, T. Anthony, and D. Turnbull Dec. 1965 23 p refs Presented at Am. Phys. Soc. Meeting, Chicago, Oct. 1965 (Contract ARPA SD-88)

(ARPA-20; AD-630459) CFSTI: HC $1.00/MF $0.50

The diffusivities, D, of copper and silver in high purity lead have been measured by a radioactive tracer technique. The results, in combination with those of Seith and Keil and Ascoli et al. show that the rates of diffusion of the noble metals in lead are several orders of magnitude greater than the self diffusion rate of lead, D_{Pb}. We have found that D_{Pb} is not measurably affected by the dissolution of either gold, in agreement with Seith and Keil, or of copper. The results indicate that neither the vacancy, interstitialcy nor exchange mechanisms are predominant in the diffusion of these solutes. It is concluded that the noble metals are dissolved in lead at least partially in the interstitial state and that they diffuse almost wholly by an interstitial mechanism. Author (TAB)

N66-25632# Chalmers Univ. of Technology, Goteborg (Sweden).

MINERALOGRAPHY IS AT LEAST AS NECESSARY AS METALLOGRAPHY [MINERALOGRAFI AR LIKA NODVANDIG SOM METALLOGRAFI]

J. Arvid Hedvall 1965 21 p In SWEDISH; ENGLISH summary *Its* Trans. No. 306 Avdel. Kemi och Kemisk Teknologi 46

CFSTI: HC $1.00/MF $0.50

Industrial applications of new products, such as silicates, oxides, carbides and their combinations with metallic phases, are discussed. It is pointed out that the number of such nonmetallic substances studied in mineralography is greater than the number of metals and nonmetallic alloys. Therefore, it is stated, because of the influence of chemical composition, crystalline structure, lattice imperfections, etc., on the qualities and the way they are used, it is obvious that mineralographic investigations are as important as metallographic research work. Transl. by R. Ll.

N66-25638# France. Ministere de l'Air, Paris.

CONTRIBUTION TO THE STUDY OF THE AGING OF THE ALLOY AL-12% AG [CONTRIBUTION A L'ETUDE DU VIEILLISSEMENT DE L'ALLIAGE AL-12% AG]

Marguerite Fumeron (Poitiers Univ.) Serv. de Doc. Sci. et Tech. de l'Armement, Mar. 1966 60 p refs In FRENCH

(Rept.-423) CFSTI: HC $3.00/MF $0.50

Aging and structural hardening in aluminum-12% silver alloy were studied, using hardness and tensile tests, X-ray diffraction, and electron microscopy. Successive states of precipitation and two modes of hardening due to crystal dislocations under conditions of shear stress are discussed. The first mode of hardening, i.e., cold hardening in an environment of 135° C, is described as a function of time and temperature. The second mode of hardening, i.e., heat hardening in an environment of 270° C, is described as temporary, disappearing when the precipitation is complete. D.T.

N66-25663# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.

THE HIGH-TEMPERATURE TENSILE PROPERTIES AND MICROSTRUCTURE OF AUSTENITIC STEELS AFTER IRRADIATION

J. R. Caley and J. Standring 1966 26 p refs

(TRG-1108(C))

Tensile tests in the range 600–850° C have shown that neutron irradiation reduces the ductility of two annealed austenitic steels (M316L and 20 Cr/25 Ni/Nb). Metallographic examination has demonstrated that nucleation and propagation of intergranular cracks has been promoted by irradiation, thus reducing the amount of grain deformation before failure. Pre-strained M316L showed a similar loss in ductility, but this only became evident in tensile tests above 650° C. Author

N66-25680# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF CONCENTRATION DEPENDENCE OF THE INTENSITY OF ALUMINUM AND ZINC LINES IN CONTACT-PULSE SAMPLING OF THE AL-ZN ALLOY SUBSTANCE

D. P. Milenina, N. K. Rudnevskiy, and T. M. Safoneyeva 1 Feb. 1966 8 p refs Transl. into ENGLISH from Tr. po Khim. i Khim Tekhnol. (Gor'kiy) no. 1, 1963 p 8–11

(FTD-TT-65-1639/1+2+4; AD-630412) CFSTI: HC $1.10/MF $0.50

Contact-pulse sampling of the substance of an Al-Zn alloy of various composition with subsequent combustion of the sample in an ac arc and recording of line intensity by means of a FES-1 was investigated. This method makes it possible to obtain in logarithmic coordinates a linear dependence of the absolute and relative intensities of the zinc and aluminum lines on the concentration of these elements for a very wide interval. The role of polarity on contact-pulse sampling of test alloys was investigated and it was demonstrated that the angular coefficient of the dependence lgI = f(lgC) for the aluminum line is greater with a positive polarity and for the zinc line with a negative polarity. The angular coefficient for relative line intensity is greater in the case of positive polarity. Author (TAB)

N66-25756# Joint Publications Research Service, Washington, D. C.

SOVIET CONFERENCES ON MATERIAL SCIENCE AND METALLURGY

20 May 1966 64 p refs Transl. into ENGLISH from Soviet periodicals

(JPRS-35625; TT-66-32060) CFSTI: $3.00

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17. SECOND SCIENTIFIC AND TECHNICAL CONFERENCE OF PLANT LABORATORY WORKERS IN LIGHT-ALLOY METALLURGICAL ENTERPRISES F. L. Lokshin p 58–60

N66-25827# Naval Research Lab., Washington, D. C.
FRACTURE TOUGHNESS CHARACTERISTICS OF SOME TITANIUM ALLOYS FOR DEEP-DIVING VEHICLES
Robert J. Goode and Ralph W. Huber 28 Jul. 1965 13 p refs Presented at the Met. Soc./AIME Meeting, Philadelphia, Oct. 1964
(NRL-6255; AD-620165) CFSTI: HC $1.00/MF $0.50

The notch-fracture-toughness characteristics of a wide variety of titanium alloy plate are being investigated to provide alloy selection design and specification criteria for the use of titanium alloys as hull-materials for deep-diving submarines and other structural applications. The relationships between various standard and newly developed fracture-toughness tests have been established for one-inch thick rolled plate, and the results from these tests have been correlated to the performance of the material in a structural prototype element test. A preliminary fracture diagram is presented for titanium which relates fracture toughness to strength level and the performance of the material in the structural prototype element test in the presence of flaws. The optimum materials trend line has been established, which indicates the maximum strength level for any given level of toughness. The fracture toughness characteristics of a number of titanium alloys and their relationship to the optimum materials trend line have been delineated. Results of the alloy development and processing investigation provide useful guidelines for optimization of strength and toughness of titanium alloys. Author (TAB)

N66-25844# General Electric Co., Schenectady, N. Y. Materials and Processes Lab.
DEVELOPMENT OF HOT-CORROSION RESISTANT ALLOYS FOR MARINE GAS TURBINE SERVICE Final Summary Report
Paul A. Bergman, Chester T. Sims, and Adrian M. Beltran 21 Jan. 1966 146 p refs
(Contract N600(61533)63218)
(MEL-131-66; AD-629786) CFSTI: HC $4.00/MF $1.00

A program was initiated to develop improved hot-corrosion-resistant alloys for Naval gas turbines. Two series of nickel-base alloys and one series of cobalt-base alloys plus appropriate commercial alloys were studied for possible service as blades and vanes, respectively. Hot-corrosion testing was conducted in two simulated gas turbine burner rigs, one designed particularly for this program. Test variables of temperature, air/fuel ratio, specimen configuration, and atomization effects have been studied using combusted diesel fuel and fixed amounts of sulfur and with salt injected. Proper conditions to achieve reproducible and discriminating hot-corrosion attack have been established. Relative behavior of both experimental and commercial alloys have been determined. The effects of individual element additions appear to have been identified in certain instances; in other cases, compositions were too complex for such separation. Thus, the effects of several elements in nickel-base alloys appear clear, but longer-time testing is recommended for cobalt-alloys. Mechanical properties and microstructures of alloys designed for this program are studied and reported. Author (TAB)

N66-25849# Frankford Arsenal, Philadelphia, Pa.
RELATIONSHIP BETWEEN EMBRITTLEMENT BEHAVIOR AND INTERFACIAL ENERGIES FOR COPPER WETTED WITH BINARY BISMUTH–THALLIUM LIQUID METAL ALLOYS AT 650 F
Bernard J. Rogus Feb. 1966 30 p refs
(R-1800; AD-630420) CFSTI: HC $2.00/MF $0.50

Embrittlement behavior of copper was studied in terms of interfacial energies between the solid copper and binary bismuth–thallium liquid metal compositions. Wetted fracture strength determinations were made on copper tensile specimens which were in contact with the liquid metal alloys at 650° F. Tests were made as the relative proportions of bismuth and thallium in the liquid wetting metal were varied. It was found that the embrittling effect of bismuth on copper decreases as the thallium content of the wetting bismuth–thallium alloy is increased. This trend to higher strength values was correlated with the corresponding increase in interfacial energies for the copper–bismuth–thallium system. The embrittlement of solid copper may be related to reductions in surface energy requirements needed for crack propagation as a result of the presence of the liquid metal. However, deviations noted in the relationship between wetted fracture strength values and interfacial energies suggest that embrittlement behavior cannot be explained fully on the basis of interfacial energies alone. Author (TAB)

N66-25879# National Academy of Sciences—National Research Council, Washington, D. C. Materials Advisory Board.
COOPERATIVE ANALYSIS PROGRAM ON REFRACTORY METAL ALLOYS

Feb. 1966 50 p refs
(Contract ARPA SD-118)
(MAB-217-M; AD-630276) CFSTI: HC $2.00/MF $0.50

As a part of the Refractory Metals Sheet Rolling Program, reference materials (unalloyed W,T-111 Ta, FS-85 Cb, and TZM Mo) were prepared and analyzed by 25 cooperating laboratories. No serious problems were encountered in determining alloying elements. Hydrogen and carbon determinations could be made satisfactory at the levels encountered, but agreement on oxygen and nitrogen was not satisfactory below the 10 ppm level. Recommendations for research to solve remaining problems are offered. Author (TAB)

N66-25899# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
THE LOW PRESSURE OXIDATION OF COPPER SINGLE CRYSTALS
Don Frederick Mitchell (Ph.D. Thesis) Mar. 1966 153 p refs
(Contract Nonr-474(11))
(MS-3531-102-66U; AD-629903) CFSTI: HC $14.90/MF $1.00

The objective of this research was to determine the mechanism of the low pressure thermal oxidation of copper, from an investigation of (1) the oxide and metal topography, (2) the structural relationships of oxide and metal, (3) the kinetics of the nucleation and growth of the islands of reaction product (nuclei). The system, copper plus oxygen, was chosen for study for two main reasons. One was that it had recently been shown that nucleation of oxide occurred on copper over a wide range of easily obtainable conditions. The second reason was that copper had previously been used for oxidation studies in this laboratory and techniques had been developed for the preparation and handling of large single crystal samples. Author (TAB)

N66-25911# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
SHORT-TIME, HIGH-TEMPERATURE CREEP STRENGTH OF MOLYBDENUM M-0.5% TITANIUM
James M. Akridge (M.S. Thesis–Maryland Univ.) Nov. 1965 94 p refs
(Contracts NOw-62-0604-c; NOrd-7386)
(TG-737; AD-630070) CFSTI: HC $9.60/MF $0.75

Short-time, high-temperature creep tests were conducted on a molybdenum–0.5% titanium alloy. Test samples were one-half inch wide × 0.060 inch thick molybdenum strip in the stress relieved condition. Prior to testing the samples were coated with a silicide oxidation resistant coating (Pfaudler PFR-6). The tests were conducted at four stress levels ranging from a low of 8470 psi to a high of 20350 psi. Temperatures ranged from 2300°F to 3000°F. Time under load was in general less than 1000 seconds. The creep strength of this alloy was found to decrease very rapidly with increasing temperature at temperatures between 2300°F and 2600°F. At temperatures above 2600°F strength decreased less rapidly with increasing temperature. This phenomenon is believed to be caused by recrystallization and grain growth at temperatures between 2300°F and 2600°F. At temperatures above 2600°F recrystallization was essentially complete before the sample was loaded, approximately 15 seconds, resulting in less sensitivity to temperature in this range. TAB

N66-25934# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THE DIFFUSION OF GOLD AND SILVER IN TIN SINGLE CRYSTALS
Brian F. Dyson Jan. 1966 16 p refs
(Contract ARPA SD-88)
(ARPA-22; AD-630458) CFSTI: HC $1.00/MF $0.50

The diffusitivities D, of gold and silver in high purity tin have been measured along the 'C' and 'a' directions in the temperature range 135–225° C. The results are characterized by a very large anisotropy of diffusion compared with that found for the self diffusion of tin. Furthermore, these solutes diffuse orders of magnitude faster than the self diffusion of tin and also they diffuse fastest along the 'c' direction, whereas tin diffuses fastest along the 'a' direction. This unusual behavior is interpreted as evidence that silver and gold dissolve interstitially in tin and diffuse by an interstitial mechanism. TAB

N66-25939# General Electric Co., Philadelphia, Pa. Missile and Space Div.
INVESTIGATION OF BONDING IN OXIDE-FIBER (WHISKER) REINFORCED METALS Final Report, 1 Jul. 1964–31 Jul. 1965
Willard H. Sutton and Earl Feingold [1965] 67 p refs
(Contract DA-19-066-AMC-184(X))
(AMRA-CR-65-01/4; AD-630359) CFSTI: HC $3.00/MF $0.75

The effect of specific active elements on the wetting and bonding of nickel to single crystal sapphire (alpha-Al_2O_3) was investigated. Sessile drop experiments were conducted using specimens of pure nickel and nickel doped with small amounts of Cr, Ti, and Zr. Both the degree of wetting (contact angle) and the apparent shear strength between solidified metal drops and the sapphire were affected by the crystallographic orientation of the sapphire surface. It was demonstrated that a maximum shear strength of about 20,000 psi could be achieved for each of the doped specimens as a result of controlling the extent of the interfacial reactions. A theory was also advanced to describe the adherence between nickel and sapphire. Author (TAB)

N66-25966# European Atomic Energy Community, Brussels (Belgium).
PLASTICITY OF DISPERSED-PHASE TYPE Al-Al_2O_3 ALLOYS [PLASTICITE DES ALLIAGES A PHASE DISPERSEE TYPE Al/Al_2O_3]
P. Guyot Sep. 1965 100 p refs In FRENCH
(EUR-2483.f)

The plastic deformation mechanisms of SAP, an alloy consisting of a dispersion of alumina particles in a polycrystalline aluminum matrix, were studied. The SAP structure was investigated in detail and a lack of coherence at the aluminum–alumina interface was found. The processes of plastic deformation were considered with regard to the deformation temperature. At low temperatures (from −196° C to room temperature), the deformation was controlled by the cutting through the forest, of which the density is high and rapidly increased with strain by the indirect presence of oxide particles. At high temperatures (from room temperature to 600° C) different processes successively occurred: cross-slip of screw dislocations and climb of edge dislocations by diffusion of jogs controlled the deformation of the aluminum matrix to about 350° C; above 350° C, the high values of activation energy and volume were partially explained by the thermal activation of the gliding of mobile dislocations pinned by the oxide particles, and by thermal activation of the bypassing of attractive trees. It is finally shown that the aluminum grain size has no influence. Author (NSA)

N66-25978# Ohio State Univ. Research Foundation, Columbus.
A STUDY OF THE MECHANISM OF STRESS CORROSION CRACKING IN THE IRON–NICKEL–CHROMIUM ALLOY SYSTEM Quarterly Report, 17 Jun.–16 Sep. 1965

R. W. Staehle 12 Nov. 1965 54 p refs
(Contract AT(11-1)-1319)
(COO-1319-32) CFSTI: HC $3.00/MF $0.50

Developments are reported for experiments on: time to cracking as affected by alloy, stress, dissolved oxygen, and sodium chloride; tensile properties as affected by temperature and alloy content; frequency of annealing twins as affected by alloy, cold work, and annealing temperature; electron metallography; and electrochemical studies. Work is under way to modify the circulating autoclave system in order to improve monitoring of data and to obtain better control of variables. Author (NSA)

N66-25980# MSA Research Corp., Callery, Pa.
RESULTS OF MECHANICAL PROPERTIES TESTS OF 316 SS SPECIMENS IN 1200 F SODIUM CONTAMINATED WITH CARBON Topical Report No. 4
R. C. Andrews, R. H. Hiltz, L. H. Kirschler, S. J. Rodgers, and F. Tepper Dec. 1965 135 p refs
(Contract AT(11-1)-765)
(MSAR-65-194) CFSTI: HC $4.00/MF $1.00

The mechanical properties of one heat of type 316 stainless steel were measured in a dynamic sodium system contaminated with carbon at 1200° F. The effects of carburization were evaluated by comparing these mechanical properties in the high-carbon sodium environment with the mechanical properties of the same heat in air, helium, and low-oxygen sodium. Both as received and 4000-hr exposed material were tested. Creep rupture and fatigue tests were conducted in the flowing sodium system, while tensile tests were conducted in air and helium at both room temperature and test temperature on exposed material. Impact tests were conducted in air at room temperature. In addition, monitoring tabs of type 316 and 304 stainless steels, 2-1/4 Cr–1 Mo steel, and Armco Iron were exposed to the high-carbon sodium environment for durations in excess of 5000 hrs. Metallurgical techniques used in post-test evaluation of the specimens and tabs included carbon analyses, microhardness measurements, microprobe analyses, metallographic analyses, standard X-ray diffraction, and chemical analyses of the extracted carbide phases. Carburization rates of the type 304 and 316 stainless steels are discussed and long-time predicted rates from short-time exposures were compared with actual measured long-time rates. Sodium chemistry, with emphasis on carbon analyses, is discussed as well as operation and post-test examinations. Author (NSA)

N66-26034# Commissariat a l'Energie Atomique, Saclay (France).
STUDIES ON THE BRITTLE FRACTURE STRENGTH OF HEAVY-GAGE STEEL PLATE Final Report No. 1
Prudhomme Constant (Inst. de Recherches de la Siderurgie) and Le Bret Weisz [1965] 29 p refs Transl. into ENGLISH from French
(Contract EURATOM-038-60-12 RDF)
(EURAEC-1520; EUR-2672) CFSTI: HC $2.00/MF $0.50

The development of a bend test to obtain detailed data on the brittle fracture phenomena encountered in welded and unwelded steel plates 200 mm thick is described. Preliminary results indicate that the transition temperature of specimens containing five scattered welds is higher than that of specimens containing one single central weld, regardless of whether this weld consists of one bead or five jointed beads. The brittle zone caused by several beads deposited alongside each other was not greater than that caused by one bead. NSA

N66-26038# Commissariat a l'Energie Atomique, Saclay (France).
CONTRIBUTION TO THE STUDY OF PITTING CORROSION OF MAGNESIUM AND ITS ALLOYS [CONTRIBUTION A L'ETUDE DE LA CORROSION PAR PIQURES DU MAGNESIUM ET DE SES ALLIAGES]
Jean Blanchet (M.S. Thesis) 1965 51 p refs In FRENCH
(CEA-R-2815)

The pitting attack of magnesium and its alloys was studied by means of potentiokinetic polarization curves; the following parameters have been considered: structural state and composition of the metal; chloride concentration; and pH of the medium. The electrochemical data obtained demonstrate that at pH 12, a localized corrosion might appear as soon as a 10^{-3} M NaCl concentration is reached; on the other hand, at pH=13, a much higher concentration (five times) has no effect. In the same conditions, the coupling of magnesium with various noble materials (graphite, platinum, 18/10 stainless steel) also severely increases its susceptibility to pitting, but only when chloride ions are present in the solution. Usual corrosion tests confirmed these electrochemical results. A micrographic study of the pits showed that their morphology is connected with the metallurgical state of the specimens. Author (NSA)

N66-26043# Neratoom (N. V.), The Hague (Netherlands).
METHODS FOR THE FABRICATION OF PRESSURE VESSELS Quarterly Report No. 13, 1 Apr.–30 Jun. 1965
C. J. Hybbard, G. W. Tichelaar, and J. W. Velzeboer 1 Jul. 1965 43 p
(Contract EURATOM-069-61-12 RDN)
(EURAEC-1468; EUR-2391) CFSTI: HC $2.00/MF $0.50

The microstructures, mechanical properties, and chemical analyses of welds in 200 mm thick plates of 1.2 MD07 steel are given. The welds were produced by the boxed CO_2 method using three electrodes. NSA

N66-26044# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
INTERNAL OXIDATION OF Fe–Al ALLOYS
Henryk Matyja and Jan Bieszkiewcz Jul. 1965 27 p refs
(INR-644/XIV/PS)

The oxidation conditions that do not lead to formation of external zone of iron oxides were found. The kinetics of the internal oxidation process were studied, and from the parabolic growth rate law: $x^2 = kt$ for 800, 900, 1000, and 1050°C, the activation energies were calculated. It was proved that as the concentration of Al increases the depth of penetration decreases and on the samples with 5.18 wt% Al the internal oxidation process was not observed. Author (NSA)

N66-26057# Societe d'Etudes, de Recherches et d'Application pour l'Industrie, Brussels (Belgium).
DYNAMIC CORROSION TESTS OF CARBON STAINLESS STEEL IN PRESSURIZED WATER [ESSAIS DYNAMIQUES DE CORROSION D'ACIERS AU CARBONE ET INOXYDABLE DANS L'EAU PRESSURISEE]
M. Warzee, P. de Dorlodot, and J. Waty Brussels, EURATOM, Mar. 1966 32 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-089-62-7 RDB)
(EUR-2688.f; EURAEC-1546) CFSTI: HC $2.00/MF $0.50

A grade of austenitic 18–10 stainless steel (AISI 304) with 0.04% C and a grade of low alloy steel used in boiler manufacturing have served as basic material for the tests. Four quite different surface treatments have been compared: tool machining, grinding, mechanical polishing up to grade 600 and electrolytic polishing in an aceto-perchloric bath.

It has been examined if the influence of the surface state upon corrosion at 300°C, which appeared in static conditions, still persisted under dynamic conditions at flow speeds comprised between 2 and 18 m/sec. In the case of AISI 304 steel, it appears that the advantage gained with electrolytic polishing remained provided the speed did not exceed 5 m/sec. At higher flow speeds, (10 and 18 m/sec.), a levelling of corrosion results for all surface states appears, together with an appreciable lowering of corrosion at 18 m/sec. As concerns boiler steel, it is noted that the advantage gained by electropolishing, appearing under static conditions, disappeared in dynamic tests, even at 2 m/sec. This must probably be explained by important erosion–corrosion phenomena characterizing this type of steel under dynamic conditions. A proportion of 90 to 99% of total corrosion is due to the release of oxide to the system, with almost linear kinetics rating from 150 to 400 mg/dm^2/month for flow speeds of 2 to 10/sec. Author

N66-26085# Massachusetts Inst. of Tech., Cambridge. Metals Processing Lab.

DEFORMATION PROCESSING OF ANISOTROPIC METALS Quarterly Progress Report, 1 Oct.–31 Dec. 1965

W. A. Backofen, D. H. Avery, D. Lee, and D. L. Holt Mar. 1966 58 p

(Contract NOw-66-0068-d)

(QPR-2) CSCL 11F

Work during this period was increasingly concerned with the structural basis of superelasticity. In the Al–Cu eutectic alloy, metallographic observations were correlated with the markedly different behavior of hot worked material as compared with as-cast, and with measurements of strain rate sensitivity, m, in the hot worked material. Structural observations were also made on the 5Al–2.5Sn titanium alloy in the temperature range 1000° to 1020°C, over which the beta phase appears and m is high. The effects of prior cold work and grain size on strain rate sensitivity were also investigated in the latter material. Alloy development work was concerned with the electrodeposition of Pb–Sn composites and the strain rate sensitivity and elongation in the ultra fine grain magnesium alloy ZK60. There were clear indications in this effort that the powder metallurgical approach to synthesizing superplastic material is a potentially fruitful one. Author

N66-26176# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.

HIGH-TEMPERATURE COLUMBIUM AND TANTALUM ALLOYS

H. R. Babitzke, R. E. Siemens, and H. Kato 1966 24 p refs (BM-RI-6777)

To develop alloys suitable for use at elevated temperatures, columbium and tantalum were combined with tungsten, hafnium, vanadium, zirconium, and titanium, and the resulting alloys were evaluated with respect to fabricability, hardness, electrical resistivity, strength at elevated temperatures, oxidation resistance, and bend transition. Of the 23 compositions tested, Cb–20Hf–5W–10Ti exhibited superior high-temperature properties. A recrystallized sample of this alloy was fabricable at room temperature, had a strength of 44,000 psi at 1,200°C, and had an oxidation rate of only 7.7 mg/cm^2/hr at 1,000°C. Author

N66-26224# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF INFLUENCE OF PRELIMINARY PLASTIC STRAIN AND NATURAL AGING ON BEHAVIOR OF LOW-CARBON STEEL

G. B. Talypov *In its* Invest. of Elasticity and Plasticity 11 Jun. 1966 p 290–294 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

Results are presented of a study on the influence of preliminary plastic deformation and natural aging on the behavior of low carbon steel under load. The investigation was conducted in parallel for plane stressed state on tabular samples and axial tension on Gagarin samples. The study showed that natural aging within limits of up to 4.5 months after preliminary plastic deformation leads to a gradual increase in yield stress. After further aging, the yield stress approaches the value of its limits before aging. R.N.A.

N66-26236*# IIT Research Inst., Chicago, Ill.

GRAPHITE-METAL COMPOSITES Quarterly Report No. 3, Feb. 1–May 1, 1966

Y. Harada 21 Apr. 1966 42 p refs

(Contract NASr-65(09))

(NASA-CR-74904; IITRI-G6003-3) CFSTI: HC $2.00/MF $0.50 CSCL 11F

Progress is reported in a program to investigate liquid phase sintering in graphite-metal composites during hot pressing at elevated (2800°C to 3100°C) temperatures. Compositional studies included a broad study of tantalum and niobium composites having metal contents of 50 to 90 wt%. In addition, systems containing molybdenum, vanadium, and titanium, were examined in a continuing general study of metal carbide-graphite composites and their properties. The use of metal oxides as the metal source was examined, and experiments were conducted to determine actual metal content in fabricated billets. Physical property measurements were made at elevated temperatures, and thermal shock tests were initiated. C.T.C.

N66-26246*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.

AN EXPERIMENTAL INVESTIGATION OF THE RE-ENTRY BEHAVIOR OF METALS AND ALLOYS

R. N. Pinchok and J. M. Bridges 31 Dec. 1964 152 p refs

(NASA-CR-75093; WANL-TNR-192) CFSTI: HC $5.00/MF $1.00 CSCL 11F

This report describes an experimental investigation of the re-entry behavior of a series of metals and alloys currently envisioned as being important structural components in the NERVA reactor. In this investigation the re-entry behavior of one-half inch models was examined in a plasmajet facility. The materials studied were aluminum 6061-T6, aluminum alloy 2219-T852, titanium A 110-At, stainless steel 304-A, Inconel-X750, and beryllium. As a result of this study the following conclusions can be made: The ablation of aluminum, aluminum alloy, and titanium is determined entirely by the melting process. In the case of titanium and stainless steel, the presence of a thick, tenacious oxide coat on the samples surface inhibits ablation. However, on pre-oxidized stainless steel samples, where cracks and spalling of the oxide layer were evident the ablation process is accelerated. The ablation of Inconel-X and stainless steel at high heating rates is similar to that of aluminum, aluminum alloy, and titanium. Author

N66-26330# Battelle Memorial Inst., Columbus, Ohio.

SURVEY OF CURRENT KNOWLEDGE OF THE DEFORMATION CHARACTERISTICS OF BERYLLIUM, THE REFRACTORY METALS, AND THE SUPERALLOYS Final Technical Report, 10 Feb. 1965–10 Feb. 1966

F. W. Boulger, A. F. Gerds, W. A. Glaeser, H. J. Henning, A. T. Hopper et al 10 Feb. 1966 322 p refs

(Contract NOw-65-0259c)

(AD-630427) CFSTI: HC $7.00/MF $1.50

The report covers the following subjects: theory of plasticity, high-velocity forming, work-hardening mechanisms in metals, shear forming and spinning of metals, friction

and wear in metal-deformation processes, rod, wire, and tube drawing, and applications of static high pressure to the forming of metals—hydrostatic extrusion. TAB

N66-26358# Martin Co., Baltimore, Md.
EFFECT OF SURFACE ON THE MECHANICAL PROPERTIES OF METALS Summary Report, 1 Feb.–31 Oct. 1965
Irving R. Kramer Wright-Patterson AFB, Ohio. AF Mater. Lab., Jan. 1966 49 p refs
(Contract AF 33(657)-10509)
(AFML-TR-66-4; AD-630949) CFSTI: HC $2.00/MF $0.50

Measurements were made on single crystal and polycrystalline specimens of high purity aluminum and Armco iron to determine: the net shear stress acting on mobile dislocations, t*; the stress due to internal obstacles opposing the motion of the mobile dislocations, t(i); and the stress associated with the dislocation rich surface layer, t(s). For aluminum single crystals, t(i) is 0 in Stage I and increases rapidly in Stages II and III. For the polycrystalline aluminum, t(i) increases at the onset of deformation. Compared to the plastic stress, t(p), the stress ratios t*/t(p), t(i)/t(p) and t(s)/t(p) are the same for single and polycrystalline aluminum at the same strain in Stages II and III. The surface stress for iron and molybdenum is much larger than that for aluminum. A preliminary investigation on molybdenum indicates that as the ratio of the surface to the plastic stresses in a direction normal to the cross section of the specimen approaches 1, the specimen becomes brittle. It also appears that the fatigue mechanism may be studied by the change in yield point due to the surface layer. Measurements before and after cyclic stressing show that the surface stress and the effect of internal obstacles are not influenced by the cycling phase. Author (TAB)

N66-26419# National Academy of Sciences—National Research Council, Washington, D. C.
EVALUATION TEST METHODS FOR BERYLLIUM
Mar. 1966 57 p refs
(Contract ARPA SD-118)
(MAB-205-M; AD-631183) CFSTI: HC $3.00/MF $0.75

The report was prepared to establish standardized methods and procedures for conducting mechanical property tests on beryllium. The data presented are restricted to information which is well established and accepted, but the report also identifies areas of testing controversy and highlights current technical needs in the testing area. The report attempts to document recommended methods, based on a review of the procedures used in a number of organizations. For various reasons, many will want to deviate from these methods. To permit reliable inter-comparisons between laboratories, standardized methods are needed; and it is hoped that for this reason these methods will be adopted. Recommended procedures for tensile, 3-point bend, 4-point bend and precision elastic limit tests are described.
Author (TAB)

N66-26448# Bettis Atomic Power Lab., Pittsburgh, Pa.
AN EXAMINATION OF THE EFFECTS OF THERMAL TREATMENT ON THE DISTRIBUTION OF ALLOYING ELEMENTS IN ZIRCALOY-2
R. F. Gessner (B.S. Thesis—Carnegie Inst. of Tech.) Dec. 1965 27 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-T-1809) CFSTI: HC $2.00/MF $0.50

Electron microprobe analyses were performed on specimens of Zircaloy-2 which were slowly cooled from the $\alpha+\beta$ and β regions as well as on as-rolled specimens. Tin was found to concentrate in α grains formed during the cooling with concomitant tin depletion in the grain boundaries. Grain boundaries were enriched in iron, chromium, and nickel, but the grains themselves showed no evidence of depletion of these constituents. This anomaly was attributed to the analytical method utilized where a very fine electron beam was focused on the specimen. Author (NSA)

N66-26465 Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
SPECIFICATIONS OF CERTAIN STEELS FOR NUCLEAR REACTOR PRESSURE VESSELS [SPECIFIKACE NEKTERYCH OCELI PRO TLAKOVE NADOBY JADERNYCH REAKTORU]
Jiri Cervasek 1965 27 p In CZECHOSLOVAKIAN
(UJV-1405/65)

Steels used in the pressure vessels of various nuclear reactors are listed. The examples cited are all in the United States except for one application in Sweden. Complete specifications, chemical analysis, mechanical, and metallographic characteristics, are given for the steels. These are listed under different types as follows: ferritic-pearlitic carbon steels—ASTM A 212 grade B and steel No. 2103/R3; low-alloy Mn–Mo steels—ASTM A 302 grade B and steel No. 345; and high strength steels—Fortiweld Steel. The results of extensive laboratory tests on samples of the steels are presented.
NSA

N66-26470# Cornell Univ., Ithaca, N. Y. Dept. of Materials Science and Engineering.
ON THE EFFICIENCY OF DISLOCATION CLIMB IN METALS
R. W. Balluffi and D. N. Seidman Oct. 1965 59 p refs
(Contract AF(30-1)-3504)
(NYO-3504-2) CFSTI: HC $3.00/MF $0.75

A wide variety of dislocation climb experiments were analyzed quantitatively with the object of determining in each case the magnitude of the maximum possible force driving climb and the ability of the dislocations to climb in response to this force. In general, the results indicate that the Frank three-dimensional dislocation network is very often capable of climbing with a high efficiency in pure metals. In the case of the high stacking fault energy metal, aluminum, climb appears to be highly efficient in the presence of large to moderate driving forces. Climb in the low stacking fault energy metal, gold, ranges from highly efficient to moderately efficient in the presence of large to moderate driving forces. No data are available for establishing lower limits of the climb efficiency under very small driving forces. The very limited climb data available for the Frank dislocation network in alloys over a wide range of driving forces indicate that climb efficiencies are generally lower in alloys than in pure metals. Climb during dislocation loop shrinkage appears to be highly efficient. Kinetic data are needed for loop growth. A number of aspects of dislocation climb were discussed and some assessment of the present status of the climb problem was attempted. Author (NSA)

N66-26483# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
STAINLESS STEEL FAILURE INVESTIGATION PROGRAM Second Quarterly Progress Report, 1 Jul.–30 Sep. 1965
T. J. Pashos, comp. Oct. 1965 57 p refs
(Contract AT(04-3)-189)
(GEAP-4968; EURAEC-1541) CFSTI: HC $3.00/MF $0.75

Results of 24 hrs stainless steel in boiling HNO_3–$K_2Cr_2O_7$ indicate that irradiation exposure increases susceptibility to corrosion. The weight loss of irradiated cladding samples was consistently higher than that of unirradiated control

specimens by a factor of two. Autoclave testing in high temperature $FeCl_2$ solutions was improved to reproducibly produce intergranular cracking of type 304 stainless steel. There was a marked difference in results of corrosion tests in $FeCl_2$ solution between unirradiated commercial type 304 stainless steel cladding and the cladding from co-extruded UO_2 in stainless steel fuel rod. Commercial tubing cracked intergranualarly in from 1 to 2 days whereas the co-extruded specimen had not failed after 8 days exposure. Tensile tests at 650° F and at strain rates of 0.024 and 0.0024 in/in/min and at constant load were performed on irradiated cladding samples. The tensile fractures were all transgranular and ductile with no evidence of intergranular separation. Electron microscopy was performed on an incipient crack that extended one-third of the way through the cladding. The tips of the crack were observed to be rounded with no evidence of mechanical fracture. Author (NSA)

N66-26504# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MOLTEN METALS AS HIGH-TEMPERATURE LUBRICANTS
N. M. Fialko and A. I. Dintses 20 Jan. 1966 11 p refs Transl. into ENGLISH from Khim. i Tekhnol. Topliv i Masel (Moscow), no. 3, 1964 p 54–58
(FTD-TT-65-1447/1+2+4; AD-629415) CFSTI: HC $1.00/MF $0.50

Investigations of molten metals for use as lubricants is reported. The procedures of the experiments to determine corrosive aggressiveness and diagrams of the apparatus are included. The corrosive aggressiveness of bismuth, cadmium, tin, lead, zinc, and two eutectic alloys were evaluated. A method of predicting the metallic interactions was devised. It was pointed out that at 500° C all metals oxidize in air, and that therefore the metals must be placed in an inert atmosphere or a high vacuum. The interaction of liquid metals with construction alloys, the high specific gravity of metals, and their relatively high cost were mentioned. On the basis of these considerations, it was concluded that the development of liquid lubricants for use at 400–700° C should be done with inorganic salts. N.E.N.

N66-26516# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
X-RAY STUDY OF THE K-STATE IN METALLIC SOLID SOLUTIONS Final Report, 19 Oct. 1962–18 Oct. 1965
Albert G. Guy 8 Dec. 1965 10 p refs
(Contract DA-31-124-ARO(D)-51)
(AROD-3735-9; AD-625829) CFSTI: HC $1.00/MF $0.50

The following important results were obtained in the investigation of the K-effect in nickel–aluminum alloys. Nickel–aluminum alloys containing 8.2 and 11.3 at. % Al were treated to produce the 'K-state' in various degrees and were then studied using X-ray scattering, small angle scattering, electrical resistivity and electron microscopy. The results were interpreted as showing that the K-state phenomena can be attributed to different structural states in the two alloys studied. In the 8.2 at. % Al alloy, representative of compositions in the solid-solution region, the anomalous increase in resistivity indicative of the K-state was attributed only to short-range order. In the 11.3 at. % alloy, which lies in the two phase region of the equilibrium diagram, this K-state phenomenon was attributed primarily to Guinier–Preston zones and secondarily to short-range order. Thus, an important property characterizing the K-state, the increase in electrical resistivity, was found to be caused by two different structural changes. TAB

N66-26582# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Metallurgy and Ceramics Research Lab.
ON THE FATIGUE LIMIT BEHAVIOR OF IRON AND MILD STEEL Final Technical Documentary Report, Jun. 1962–Mar. 1965
Attwell M. Adair and Harry A. Lipsitt Dec. 1965 23 p refs
(ARL-65-255; AD-629787) CFSTI: HC $1.00/MF $0.50

A critical review of research in recent years on the fatigue limit behavior of iron and mild steel is combined with experiments on zone-refined iron to demonstrate the importance of interstitial-dislocation reactions to the nature of the fatigue limit. The controversy over whether the fatigue limit in ferritic materials results from a characteristic peculiar to the iron (bcc) lattice or results from strong initial dislocation locking and dynamic strain aging is somewhat clarified. It is shown that each of the extant ideas have some merit, and that each of the mechanisms thus far proposed are necessary, but individually insufficient, to provide the desired level of understanding of the fatigue limit behavior of metals. Author (TAB)

N66-26588# Systems Research Labs., Inc., Dayton, Ohio.
THE ELECTRICAL BEHAVIOR OF REFRACTORY OXIDES III Final Technical Report, 15 Feb. 1964–1 Jun. 1965
Robert W. Vest, Julian A. Crawford, and Walter C. Tripp Wright-Patterson AFB, Ohio, ARL, Dec. 1965 111 p refs
(Contract AF 33(657)-10815)
(ARL-65-259; AD-629776) CFSTI: HC $4.00/MF $0.75

The research was directed toward achieving a more fundamental understanding of charge and mass transport mechanisms in refractory metal oxides. Special research apparatus and instrumentation was developed in order to carry out the experimental program. The defect structure of tetragonal ZrO_2 was studied by investigating the conductivity, transference number and the monoclinictetragonal phase change. Measurements of electrical conductivity and thermoluminescence of Y_2O_3 are presented. The results of thermogravimetric studies and electron microscopy work are also presented. Author (TAB)

N66-26611# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.
EVALUATION OF REFRACTORY SHEET METALS, PART II
George E. Gazza and Thomas S. Desisto Oct. 1965 12 p refs
(ARMA-TR-65-25, Pt. II; AD-630771) CFSTI: HC $1.00/MF $0.50

Four tantalum base alloys, one molybdenum base alloy, and one tungsten base alloy were evaluated. Mechanical properties were obtained by tensile testing at temperatures to 3500° F, stress-rupture testing to 3000° F, and bend testing to −320° F. A comparison shows that generally the mechanical properties obtained for each alloy approach or exceed the target properties established by the Alloy Requirements and Selection Group. Author (TAB)

N66-26662*# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
[DISPERSION STRENGTHENING OF METALS] Progress Report, Sep. 1965–Feb. 1966
Nicholas J. Grant, Gary Ewell, Francis Hunkeler, William Schilling, Harish Dalal et al [1966] 17 p refs
(Grant NsG-117)
(NASA-CR-75136) CFSTI: HC $1.00/MF $0.50 CSCL 11F

The apparatus for controlled oxidation of the iron–beryllium alloy powders was constructed, and the procedural details are presented. Weight change values and preliminary metallographic observations indicate that significant amounts of

BeO formed only in those internally oxidized samples that were exposed for 24 to 30 hours at 850° and 1000° C. The microstrucures of the bulk samples showed progressive inward penetration of a precipitate zone with increased time and temperature of treatment. Research on the mechanisms of deformation and fracture in oxide dispersion strengthened alloys is also discussed. Vacuum melted copper–aluminum alloys were converted into finely machined chips and ball-milled into near micron powders. Another group of the alloys were homogenized and then cold rolled. Other research areas mentioned are: oxide dispersion strengthened alloys by surface and internal oxidation processes; internal oxidation processes; and control of chromium oxide content in oxidation resistant–oxide dispersion strengthened alloys. N.E.N.

N66-26665*# New York Univ., N. Y. Research Div.
INVESTIGATION OF THE EFFECT OF PRESSURE ON METALLURGICAL PHENOMENA Final Report, 20 Jun. 1960–30 Sep. 1965
H. Margolin, I. Cadoff, B. Siegel, and E. Pan [1965] 22 p refs (Grant NsG-90)
(NASA-CR-75106) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Research on pressure effects on lead–thallium alloys, tin telluride, and lead telluride are reported. The atmospheric phase diagram of lead–thallium alloys was investigated at the thallium rich end. Details of the resistivity apparatus and the X-ray studies are given. It was found that the resistivity of the alloy increased linearly with temperature, up to a point where a drop in resistivity occurred. This drop was attributed to crossing a phase boundary. Resistivity isotherms indicated that lead additions to pure thallium increase the resistivity until maximum solubility is reached. It was found that the topology of the isotherm resistivity curves is in agreement with previously published data, but the actual position of the boundaries is not. Electrical resistance and Seebeck coefficients of SnTe and PbTe were measured at constant pressures as a function of temperature. These properties were also measured for SnTe at constant temperatures as a function of pressure. SnTe(III) showed semiconductor behavior, and a fourth phase of SnTe was postulated. N.E.N.

N66-26671# Brown Univ., Providence, R. I. Div. of Engineering.
NEUTRON IRRADIATION AND THE YIELD SURFACES OF COPPER
T. D. Dudderar and J. Duffy Jan. 1966 86 p refs
(Contract Nonr-562(20))
(TR-48; AD-630923)

Tests were conducted to determine the effects of irradiation and plastic deformation on the yield surfaces of polycrystalline copper. It was found that the principal effect of plastic deformation on unirradiated copper was to translate the yield surface without appreciably changing its size or shape. Irradiation, on the other hand, produced a very large change in the overall size of the initial yield surface; in other words, it produced an effect phenomenologically similar to extensive isotropic strain-hardening. In addition, the shape of the initial yield surface after irradiation was dependent on the plastic strain offset chosen to define yield. This effect was not observed for the unirradiated metal. Extensive plastic deformation after irradiation caused the yield surface to translate and grow smaller without significantly changing shape. Author (TAB)

N66-26714# Texas Univ., Austin. Engineering Mechanics Research Lab.
MECHANISM OF FATIGUE IN METALLIC CRYSTALS
M. A. Wilkov and R. Shield Jan. 1965 34 p refs
(Grant AF-AFOSR-560-64)
(EMRL-RM-1003, AFOSR-560-64; AD-616341) CFSTI: HC $2.00/MF $0.50

The origin and progressive growth of cracks on the surface of (112) and (123) oriented single crystals of aluminum subjected to cyclic deformation at 77° K and 300° K were observed with a JEM 150 electron microscope. A negative carbon platinum replication technique was used which allowed a successive examination of the surface changes in a selected area on the surface of a specimen at given intervals of load application. Changes in crystallographic orientation or temperature did not appear to have any effect on the basic mode of crack formation, only the density and rate of crack growth. A tentative explanation of the mechanism of fatigue is proposed based on this work and other previous investigations. Author (TAB)

N66-26730# Royal Inst. of Tech., Stockholm (Sweden).
SOME VIEWPOINTS ON PLASTIC DEFORMATION CONNECTED WITH FRACTURE IN METALS [NAGRA SYNPUNKTER PA PLASTISK DEFORMATION I SAMBAND MED BROTT]
Gustaf Ostberg 1965 24 p refs In SWEDISH; ENGLISH summary
(Publ.-150) CFSTI: HC $1.00/MF $0.50

A seminar is reviewed which dealt with forms of plastic deformation leading to or otherwise connected with non-brittle fracture. Such subjects were discussed as: ductile failure, yield point, brittle fracture, stress concentration, grain and crystal structure, nonuniform deformation, and plastic fatigue. Other topics were also investigated, including: anisotropic materials, strain hardening, uniform and nonuniform elongation, biaxial stress, plastic instability, and thin-walled internally pressurized containers. D.T.

N66-26752*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EFFECT OF MODERATELY ELEVATED TEMPERATURE ON THE FATIGUE LIVES OF NOTCHED (K_T=4) SPECIMENS WHICH CONTAIN RESIDUAL STRESS
Leland A. Imig (M.S. Thesis—Va. Polytechnic Inst.) Apr. 1966 65 p refs
(NASA-TM-X-57565) CFSTI: HC $3.00/MF $0.75 CSCL 11 F

Fatigue tests were conducted on notched (K_T=4) fatigue specimens of duplex annealed Ti–8Al–1Mo–1V sheet material (0.050 gage). Additional specimens were subjected to a single cycle of high nominal stress (called stress conditioning) prior to being tested in fatigue. Changes in fatigue lives as compared to the initial tests were noted. Further tests were made in which specimens were exposed to temperature between the stress conditioning and fatigue tests. The three temperatures were laborotory ambient (approximately 70° F), 300° F, and 550° F. The changes in fatigue life with exposure duration are noted for each temperature. Author

N66-26793# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
THE BISMUTH–ZIRCONIUM ALLOY SYSTEM
C. B. Hamilton and H. A. Wilhelm Apr. 1964 24 p refs
(Contract W-7405-ENG-82)
(IS-1269) CFSTI: HC $2.00/MF $0.50

The bismuth–zirconium alloy system was investigated by thermal and metallographic examinations of alloys prepared by heating liquid bismuth with solid zirconium in tantalum and in graphite containers. Indications are that at least three intermetallic compounds exist in these alloys. The previously established compound $ZrBi_2$ formed peritectically on cooling

at 714°C. A compound, assumed to be ZrBi, exhibited a peritectic at 1300°C, while a third compound, having the composition of Zr_3Bi_2, appeared to have a congruent melting point at 1495°C. There was evidence of a fourth compound which formed peritectically at 1340°C, near the composition of Zr_2Bi. A eutectic is reported to exist at 1290°C for 75 at.% zirconium. The maximum solid solubility of bismuth in zirconium, which occurs at this temperature, is approximately 15 at.%. No eutectic or solid solubility was observed for bismuth-rich alloys. Author (NSA)

N66-26796# National Lead Co. of Ohio, Cincinnati. Feed Materials Production Center.
A STUDY OF AS-CAST AND HEAT-TREATED URANIUM ALLOYS AND URANIUM CARBIDE ALLOYS BY OPTICAL AND ELECTRON MICROSCOPY
William A. Althaus, Marlin M. Cook, and Richard J. Bieker Feb. 1966 41 p refs
(Contract AT(30-1)-1156)
(NLCO-968) CFSTI: HC $2.00/MF $0.50

Examinations of as-cast uranium-base dilute-carbon alloys revealed the growth characteristics of primary carbides in the liquid state, and as-cast and heat-treated samples showed the nature of the network phases. A tentative peritectic phase diagram is proposed to explain the structures seen in as-cast samples. Age-hardening treatments revealed that uranium-base dilute-carbon alloys were not suitable for dispersion hardening processes. A fine random dispersion of carbides was unobtainable with gamma heat treating followed by alpha annealing. Author (NSA)

N66-26799# Argonne National Lab., Ill.
GLASSY MATERIALS FOR NUCLEAR REACTOR APPLICATIONS
E. D. Lynch Nov. 1965 26 p refs
(Contract W-31-109-ENG-38)
(ANL-7062) CFSTI: HC $2.00/MF $0.50

Studies were made to determine the feasibility of preparing fuel-bearing glasses and glasses bearing neutron-absorbing materials. Devitrification-resistant glasses were prepared that contained sufficient urania or rare-earth oxide to be used for fuel or control purposes, respectively. Fabrication methods were devised to form crystalline-glass mixtures to usable densities. Shapes were formed by pressing and sintering, warm pressing at 600°C, vibratory compaction and sintering, and extrusion at 800°C. A control-rod loading was fabricated by vibratory compaction of B_4C-glass into the cladding. Induction heating was used to bond the materials in the cladding tube. Glass-bonded uranium dioxide samples were prepared for Doppler-coefficient measurements.
Author (NSA)

N66-26801# General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation.
HIGH TEMPERATURE MATERIALS PROGRAM Progress Report No. 55, Part A
21 Jan. 1966 80 p refs
(Contract AT(40-1)-2847)
(GEMP-55A) CFSTI: HC $3.00/MF $0.75

Laboratory testing of Fe–Cr–Al–Y clad fueled specimens containing UO_2 or UN exceeded 10,000 hours at 950°C in air with no surface uranium concentration for iron matrix core specimens. An in-pile test of Fe–15Cr–4Al–1Y clad Fe–40UO_2 specimen is operating in the LITR at 950°C in peak flux with coolant airflow of 1700 liter/min. Improved impact properties and higher strength at 800°C were achieved in an Fe–5Cr–6Al–3Y alloy prepared by powder metallurgy techniques. Tensile testing of irradiated Fe–15Cr–4Al–1Y alloy shows that the strength at 800°C is decreased but the ductility as measured by total elongation remains unaffected by irradiation. Creep–rupture tests of arc cast tungsten sheet and W–25Re sheet at 2000°C and 0.703 kg/mm^2 in hydrogen showed tungsten to be more creep resistant than W-25Re by a factor of three in the 5–25% strain range. Evaluation of CaO as a possible thermocouple insulator inside a W–5Re sheath at high temperature in a carbonaceous hydrogen atmosphere at 2450°C indicated that pressure damage to the sheath could result. The integrity and ductility of electron beam welds in a series of W–Re–Mo alloys showed good ductility in the weld fused material. R.N.A.

N66-26810# Federal Council for Science and Technology, Washington, D. C. Coordinating Committee on Materials Research and Development.
FEDERAL MATERIALS RESEARCH PROGRAM—OPPORTUNITIES, ROADBLOCKS, PROBLEMS
Nov. 1965 38 p refs
(TID-22424) CFSTI: HC $2.00/MF $0.50

Some of the areas of research in materials that the Coordinating Committee on Materials Research and Development believes should receive increased emphasis are identified. Only subjects of significant importance to more than one Federal agency are discussed. Because of this, problems and roadblocks not recognized as of direct concern to any agency are not included, even though they may be of national importance. The major technical materials problems of most general concern to the Federal government are high temperature materials, high strength-light weight materials and the degradation of materials in use. Author (NSA)

N66-26862*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
DETERMINATION OF THE WELDABILITY AND ELEVATED TEMPERATURE STABILITY OF REFRACTORY METAL ALLOYS Ninth Quarterly Report, 21 Jun.–20 Sep. 1965
G. G. Lessmann and D. R. Stoner [1965] 77 p refs
(Contract NAS3-2540)
(NASA-CR-54923; WANL-PR(P)-009) CFSTI: HC $3.00/MF $0.75 CSCL 11F

Elevated and room temperature tensile properties of tantalum and niobium alloys were determined for base metal and gas tungsten arc welded specimens. Tensile weld joint efficiencies near 100% were obtained for all alloys throughout the temperature range. The tensile data showed that tantalum alloys were stronger than niobium alloys and have greater stability with increasing temperature. The solid solution alloys are weaker than those containing reactive element solute additions. Most alloys displayed a failure mode transition between 1800° and 2400°F. Large weld grain sizes in either weld or base metal tended to lower high temperature ductility. Oxygen contamination sensitivity in T-111, T-222, and FS-85 alloys was studied. The sensible contamination limit was identified as 1000 ppm oxygen. At this level the weld and base bend transition temperature exceeded 1000°F. Both T-111 and FS-85 have a tolerance of about 4000 atomic ppm. The threshold for T-222 is less than 2000 atomic ppm. Increased oxygen content produced higher strengths and less ductility at all test temperatures, with the strengthening effect being most pronounced up to 1800°F. R.N.A.

N66-26863*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
DEVELOPMENT OF DISPERSION STRENGTHENED TANTALUM BASE ALLOY Eighth Quarterly Progress Report, 20 Aug.–20 Nov. 1965

R. W. Buckman, Jr. and R. C. Goodspeed [1966] 42 p refs (Contract NAS3-2542)
(NASA-CR-54935; WANL-PR(Q)-009) CFSTI: HC $2.00/MF $0.50 CSCL 11F

Development of dispersion strengthened tantalum base alloys for use in advanced space power systems continued with the processing of the side forged ingot of composition NASV-20(Ta–8W–1Re–0.7Hf–0.025C) to sheet. Evaluation of this material is presently underway. Further phase identification and morphology work was performed, using optical and electron microscopy and X-ray and electron diffraction techniques. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N66-25617# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanics.
THE EFFECTS OF INTERMOLECULAR FORCES ON POLYMER RHEOLOGY. II: HYDROGEN BONDING ABOVE Tg
Edward P. Otocka and Frederick R. Eirich Mar. 1966 50 p refs
(Contract Nonr-839(32) (FBM))
(PIBAL-911; AD-630019) CFSTI: HC $2.00/MF $0.50

A series of three butadiene–methacrylic acid copolymers and three butadiene/2-methyl-5-vinyl pyridine copolymers were evaluated for Young's modulus and stress relaxation modulus between −75° C and +75° C. Corresponding members of the acidic and basic copolymer series were stoichiometrically combined to provide an intermolecularly hydrogen bonded material which was tested in the same manner. Comparison between the observed modulus temperature curves for the mixed material and the average of the parent materials' modulus-temperature curve reveals a regular, temperature dependent increase in Young's modulus above Tg. Below Tg the rate of increase decreases. The stress relaxation curves of the acidic, basic and mixed copolymers were normalized with respect to Tg. The curves were then differentiated to provide relaxation spectrum curves. The comparison of the average relaxation spectrum curves for the parent materials with that obtained for the mixed material shows depression of short time relaxation mechanisms. Infrared investigations of the hydrogen bond absorptions in stretched films are also discussed. Author (TAB)

N66-25650# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
A REFRACTORY MATERIAL RESISTANT TO THERMAL SHOCK: SATURATED TANTALUM CARBIDE [UN MATERIAU REFRACTAIRE RESISTANT AU CHOC THERMIQUE: LE CARBURE DE TANTALE IMPREGNE]
Andre Hivert 1966 36 p refs In FRENCH Presented at the Colloq. on Mater. for Use in Space, Paris, 7–11 Feb. 1966
(ONERA-TP-323(1966)) CFSTI: HC $2.00/MF $0.50

Some calcinated glassy fragments with stable porosity were saturated with metal in an investigation to improve the thermal shock resistance of tantalum carbide. The natural calcination of tantalum carbide was studied with refractometry; and the influence of lesser amounts of additives was observed. It was found that copper is a particularly good inhibitor which permits the achievement of an open and stable porosity from 20 to 40%. The saturation of the glassy fragments with silver and copper was realized with two processes. It was demonstrated that, after these operations, the refractory lattice did not sustain any damage. In addition, it remains undamaged throughout the course of the fragments' use. Finally, it is pointed out that these saturated cermets show an outstanding resistance to thermal shock, and that their resistance to oxidation is greater than that of dense tantalum carbide. Also, they demonstrate outstanding mechanical strength to 3200°C. Transl. by D.T.

N66-25840# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
THEORETICAL STUDIES ON THE DEGRADATION OF LADDER POLYMERS. PART II: VAPORIZATION STUDIES Summary Report, Jan.–Dec. 1964
Martin M. Tessler Dec. 1965 57 p refs
(ML-TDR-64-151, Pt. II; AD-629740) CFSTI: HC $5.60/MF $0.75

The random degradation of four and six-membered ring ladder polymers were investigated by means of a digital computer and the results compared to a single chain polymer undergoing degradation under identical conditions. The percent vaporization versus time and the rate of weight loss versus time was plotted and significant differences were obtained. The results indicate that ladder polymers should have increased stability over single chain polymers undergoing random degradation. Author (TAB)

N66-25851# Office of Naval Intelligence, Washington, D. C. Translation Section.
PLASTICS-BASED ANTICORROSIVE COATINGS. SYNTHETIC COATINGS FOR SHIPS' HULLS [SINTETICHESKIYE MATERIALY V SUDOSTROYENIE I SUDOREMONTE]
[1966] 7 p Transl. into ENGLISH from Morsk. Transp. (Moscow), 1962 p 150–158
(ONI-Transl.-2108; AD-629731) CFSTI: HC $1.10/MF $0.50

Anticorrosive synthetic paints for ship hulls are discussed. Painting procedures for ships with different sailing requirements are listed. The composition of various primers, and the application of ethanol paint are mentioned. Anticorrosive coverings of vinyl paints and paints based on epoxy resins are described, including the particular use and the number of layers recommended. It is pointed out that paints based on synthetic resins are most stable for ships sailing in tropical and subtropical waters. Paints are indicated for use as protection against molds, microorganisms, and insects such as termites. Paints for both the underwater and the above water sections of the hull are designated. N.E.N.

N66-25869# Naval Ordnance Lab., White Oak, Md.
A MULTIAXIAL FATIGUE TEST FOR EVALUATION OF PLASTICS COMPOSITE MATERIALS Interim Report
Marlin A. Kinna and Stanley P. Prosen 10 Feb. 1966 31 p refs
(NOLTR-65-191; AD-630434) CFSTI: HC $2.00/MF $0.50

An NOL Multiaxial Fatigue Test Method has been developed to obtain information on the dynamic properties of plastics composite materials. The test method uses an NOL ring segment as the test specimen, and strain gages mounted on a specially prepared post are used to monitor the resistance of the specimen to the applied multiaxial load. Results

obtained in a statistical experiment set-up to evaluate the test method show that it is capable of differentiating between materials and/or fabrication parameters. In addition, reproducibility of the results is within the limits of accuracy relating to the winding, curing, and handling conditions imposed on the ring segments prior to testing. Author (TAB)

N66-25912# Pennsalt Chemicals Corp., King of Prussia, Pa.
POTENTIAL APPLICATIONS OF POLY(METAL PHOSPHINATES): ANTISTATIC COATINGS, MULTIPURPOSE THICKENERS AND EXPLORATORY STUDIES ON THERMALLY STABLE ELASTOMERS Semiannual Report, 18 Jun.–17 Dec. 1965
Anthony J. Saraceno, Peter F. Radice, Andrew J. Hamilton, Jr., and B. Peter Block Jan. 1966 42 p refs
(Contract N156-46781)
(SAR-1; AD-630262) CFSTI: HC $2.00/MF $0.50

Plasticized compositions of $[Cr(H_2O)(OH)(OPPh_2O)_2]_x$ with TCP were found to dissipate electrostatic charge both as a film per se and as a transparent coating on conventional organic film such as PE. Studies with a gold-leaf electroscope indicate better antistatic behavior with increasing thickness from 0.05 to 0.50 mils and increasing plasticizer content from 30 to 70% by weight. Some evidence of heat sealability was indicated for the 75–80% TCP plasticized compositions. In some of the coatings several resins were evaluated as matrices to improve the toughness and adhesion of the coating. An end-capped Cr hydroxyaquo methylphenyldioctylphosphinate copolymer was prepared and tested for thickening ability in methyl phenyl siloxane DC 550, Hercolube A-P.E. ester and di (2-ethylhexyl) sebacate fluids. The thickener successfully gels all three fluids to stable greases. TAB

N66-25931# Dow Corning Corp., Midland, Mich.
INVESTIGATION OF THE PHYSICAL–CHEMICAL NATURE OF THE MATRIX-REINFORCEMENT INTERFACE Technical Documentary Report, 1 Jun. 1964–1 Jun. 1965
O. Johannson, F. Stark, R. Baney et al Wright-Patterson AFB, Ohio, AF Mater. Lab., Sep. 1965 144 p refs
(Contract AF 33(615)-1667)
(AFML-TR-65-303, Pt. I; AD-629777) CFSTI: HC $4.00/MF $1.00

It was the intent of the investigation to initiate a study of those chemical phenomena which occur at the interfaces between glass and silane coupling agent and between coupling agent and resin matrix. From the data obtained on the adsorption of mono-functional silanes, it was possible to infer which reactions had occurred at the interface between coupling agent and glass. Heats of immersion of the glass in water have also been measured to determine the forces of interaction between the glass and water. The techniques which so far have yielded the most information capable of interpretation have been adsorption-desorption measurements, electron microscopic examination of treated surfaces, and isothermal heats of wetting. From the data obtained to date it is concluded that there is a very limited chemical reaction occurring between glass and coupling agent; most of the interaction at the glass interface is very weak. Conceivably the amount of reaction will be influenced by the method used to apply coupling agents to the glass surface. Author (TAB)

N66-26173# Federal Aviation Agency, Washington, D. C. Aircraft Development Service.
DEGRADATION LIMITS OF PLASTIC WINDSHIELDS IN SERVICE
Richard V. Grom and Philip R. Marshall Nov. 1965 39 p refs
(FAA-ADS-57)

A study of the optical and strength characteristics of plastic aircraft windshields was conducted to determine practical inspection tests that can be applied to in-service windshields. Portable instruments were developed to measure luminous transmittance and light scattering, and subjective visual tests were conducted to determine the effect of optical degradation on vision. Structural deterioration caused by crazing was also investigated. Project results indicate that further testing of the developmental instruments is desirable, and that additional subjective tests are needed to establish a rejection scale based upon visual performance through degraded windshields. Author

N66-26217# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON OPTICAL AND MECHANICAL PROPERTIES OF DOUBLE COPOLYMERS
T. D. Maksutova *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 201–222 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

This paper investigates the additivity, homogeneity, and stability of the optical and mechanical properties of double copolymers of styrene, methyl methacrylate, and benzyl methacrylate. The dependence of the optical and mechanical properties of these materials on temperature is shown. All three materials in a highly elastic state are characterized by low quality coefficient at relatively low values of elastic modulus. Results showed that the optical and mechanical properties of the double copolymers change monotonically, but there is no simple addition of optical and mechanical properties characterizing the materials contained in the copolymer. On the basis of benzyl methacrylate and methyl methacrylate, a material can be obtained for which the coefficient of optical activity is equal to zero in the entire range of temperatures from room temperature to 130°C. On the basis of styrene and methyl methacrylate, a material can be obtained in which the optical effect in the glassy state is determined by only highly elastic strains developing in time. R.N.A.

N66-26222# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANICAL PROPERTIES OF ANISOTROPIC LAMINAR PLASTICS DURING TESTS
N. T. Smotrin and V. M. Chebanov *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 265–280 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

This report presents the results of investigations of the mechanical properties of sheets of anisotropic fiberglass material and textolite. The sheets were prepared using epoxy-phenol and bakelite binding with longitudinal and transverse fiber ratios of 5:1, 5:4, and 1:1. The test samples and equipment used are described, and the test results are presented and discussed. R.N.A.

N66-26223# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REMARKS ABOUT STRENGTH AND DESTRUCTION OF TEXTOLITE IN A COMPLEX STRESSED STATE IN THE CASE OF SIMPLE LOADING
N. T. Smotrin and V. M. Chebanov *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 281–289 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

Plane stressed state textolite tubes were investigated under conditions of simple loading. Results showed that, in the state of delivery, elastic, strength, and strain parameters of the textolite tubes along the generator differ essentially from similar parameters along the directrix. If 100% is taken as the

indicated quantities along the generator, then the modulus of normal elasticity is 224%, Poisson's ratio is 185%, ultimate strength is 70%, and the largest elongation is 18%. The compressive strength along the generator is 145% as high as the tensile strength in the same direction. Of the three considered conditions of strength (Von Mises, Khu and Merin, and St. Venant) the conditions of St. Venant agree with experimental results better than the others. R.N.A.

N66-26346# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

LABORATORY INVESTIGATION OF PLASTIC-GLASS FIBER REINFORCEMENT FOR REINFORCED AND PRESTRESSED CONCRETE. REPORT 1: PLAIN REINFORCED CONCRETE

John C. Wines and George C. Hoff Feb. 1966 61 p refs */ts*
Misc. Paper No. 6-779
(AD-630600) CFSTI: MF $0.75

The investigation consisted of the evaluation of plastic-glass fiber elements, commonly called fiberglass, that could be used as plain reinforcement in concrete members and the design of concrete members to utilize the properties of the fiberglass elements. Fiberglass rods were tested for tensile strength, long-duration load, and elasticity and bond in concrete. Utilizing these essential properties, concrete beams were compared both experimentally and analytically with similarly designed steel reinforced concrete beams on the basis of ultimate flexural strength, deflection, and long-duration load. The low modulus of elasticity of the fiberglass rods together with the lack of a good bond between the rods and the concrete, caused the neutral axis of the beam to move up, thus reducing the compression area of the beam. The beams then failed in compression before the fiberglass reinforcement could be fully utilized. While ineffective as plain reinforcement in concrete beams, fiberglass rods, with their low modulus of elasticity and high strength, theoretically show promise if used as tension elements for prestressing concrete by the pretensioning method. Author (TAB)

N66-26429# Army Weapons Command, Rock Island, Ill. Research and Engineering Div.

COAGENTS FOR IMPROVING ELASTIC RECOVERY IN POLYESTER URETHANE ELASTOMERS Interim Technical Report

John A. Williams Jan. 1966 16 p
(RIA-66-382; AD-629972) CFSTI: HC $1.00/MF $0.50

A number of chemicals were evaluated as coagents in the peroxide vulcanization of polyester urethanes to determine their ability to produce vulcanizates with good elastic recovery. Several coagents evaluated with high levels (6 pphr) of peroxide produced vulcanizates with improved elastic recovery compared with vulcanizates crosslinked with high peroxide alone. Tensile strength was unaffected while modulus and hardness increased and elongation decreased. Certain coagents when evaluated with low levels (3 pphr) of peroxide produced vulcanizates with improved elastic recovery and only slightly decreased tensile strength compared with vulcanizates cured with high peroxide alone.
Author (TAB)

N66-26492# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

UNSTEADY STATE DESTRUCTION OF GLASS-LIKE MATERIALS IN A SUPERSONIC GAS

B. I. Reznikov 1 Feb. 1966 19 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Techn. Fiz. (Moscow), no. 6, 1964 p 69–76
(FTD-TT-65-1608/1+2+4; AD-629472) CFSTI: HC $1.80/MF $0.50

An approximate analytical solution was obtained for the problem of unsteady destruction of homogeneous glass-like materials in the region of the critical point (line) at constant (or slightly changing) conditions in the external flow. There is a clear expression for the rate of destruction of a material and the dependence of the surface temperature on time in the form of a quadrature. It was shown that the rate of destruction is determined by the surface temperature of the material and barely depends upon the rate of heating the surface. For comparatively low surface temperatures up to 2300° K there is a 'sublimation' character of destruction (the degree of gasification is close to one) and removal does not occur in the liquid phase. The results of theoretical calculations are compared with experiments. Author (TAB)

N66-26514# Army Natick Labs., Mass.

RESEARCH COMPOUNDING OF NITROSO RUBBER Final Report, Dec. 1963–Sep. 1965

Charles B. Griffis Oct. 1965 20 p refs
(C&OM-13; AD-625815) CFSTI: HC $1.00/MF $0.50

Nitroso rubber, a copolymer of trifluoronitrosomethane and tetrafluoroethylene, has been made in pilot-plant quantity by the Thiokol Chemical Corporation under Army Contract DA19-129-AMC-69 (AD-439 696). Research compounding studies have been made on this pilot-plant production rubber. A variety of cross-linking (vulcanization) agents were investigated, the most effective of which was triethylene–tetramine. Of a series of reinforcing fillers used, the best physical properties were obtained with HiSil 303. However, a silicone-treated HiSil 233 gave comparable results. The curing characteristics of the nitroso rubber made in the pilot plant at the Thiokol Chemical Corporation were different from those of the material prepared in the laboratory of the Minnesota Mining and Manufacturing Company (AD-418 638). Based on the research compounding studied made, there is no indication that rubber compounds having excellent physical properties can be made from the Thiokol Chemical Corporation nitroso rubber.
Author (TAB)

N66-26528# Alpha Research and Development, Inc., Blue Island, Ill.

INTERFACIAL INTERACTION IN COMPOSITE STRUCTURES Year End Report, Feb. 19, 1965–Feb. 18, 1966

Robert L. Patrick and William S. Layne [1966] 54 p refs
(Contract NOw-65-0305-f)
(AD-629899) CFSTI: HC $3.00/MF $0.50

Glass rod is believed to lose much of its strength as a result of interaction with minute amounts of water. To test this theory, an anhydrous cell was fabricated in which a water vapor content of less than 5 ppm. Rods treated with water lost much of their strength. Experiments were continued to determine the efficacy of removal of tritiated water from glass surfaces with distilling solvents. Water was continuously removed from the solvent with calcium hydride. Results to data indicate that water is removed very slowly and incompletely by this method. In order to examine the path of diffusion through solid epoxy or the glass-epoxy interface, cells were fabricated from DER 332/DMP 30, and were filled with water. Losses of water were measured gravimetrically. Results indicate that if diffusion is the sole source of weight loss, that losses are not greater than 0.0000003 gram/day/sq. mm. If the diffusion is along the glass epoxy interface, it is not greater than 0.6 mm/sec. Studies of

E-glass rods which had been dehydrated by roasting at 500°C followed by treatment with tritiated water was found to bind tritium tightly to the surface. After initial drying, the residual tritium was reduced to about half after four hours additional drying. Author (TAB)

N66-26606# Hughes Aircraft Co., Culver City, Calif.
A BIBLIOGRAPHY ON POLYTETRAFLUOROETHYLENE (TEFLON) PLASTICS
J. T. Milek, H. E. Wilcox, and M. Bloomfield Nov. 1965 179 p refs
(LS-BIB-65-3)

A bibliography of over two thousand references on polytetrafluoroethylene (teflon) plastics is presented. These include such information as the chemistry, properties (chemical, electrical, mechanical, thermal), applications, polymerization, special properties, fabrication processes, and crystallography of the plastics. C.T.C.

N66-26612# Picatinny Arsenal, Dover, N. J. Plastics Technical Evaluation Center.
WEATHERING OF GLASS REINFORCED PLASTICS
George R. Rugger and Joan B. Titus Jan. 1966 171 p refs
(PLASTEC-24; AD-630987) CFSTI: HC $5.00/MF $1.00

Weathering effects are reported for the following types of glass-reinforced plastics: polyesters, epoxies, phenolics, melamines, silicones, and acrylic laminates. TAB

N66-26715# Army Engineer Research and Development Labs., Fort Belvoir, Va.
PREDICTION OF MECHANICAL BEHAVIOR OF PLASTICS UNDERGOING DECOMPOSITION FROM THE COMBINED EFFECTS OF ENVIRONMENTAL EXPOSURE AND STRESS Final Report
S. Goldfein Feb. 1966 37 p refs
(Rept.-1847; AD-631001) CFSTI: HC $2.00/MF $0.50

A study was made to determine if the behavior of plastics undergoing breakdown from the effects of stress, elevated temperatures, and chemical attack could be predicted by means of a mechanical–chemical equation of state. Five systems were studied, the first four of which were tested for retention of strength at room temperature after environmental exposure: (a) Glass-reinforced polyester laminate exposed to an alkaline medium at elevated temperatures; (b) cellulose laminate exposed to elevated temperatures, resulting in oxidative degradation; (c) paper-phenolic laminate exposed to elevated temperatures, resulting in further cross-linking followed by oxidative degradation; (d) heat-resistant glass fiber polyester resin laminate exposed to very high degradative temperatures; and (e) same material and treatment as (d) except that the specimens were under stress during the exposure (stress-rupture). It is concluded that the effects of the various environments on the mechanical properties of the plastics under study can be predicted accurately by use of a parameter of the equation of state representing a second-order chemical reaction. Author (TAB)

N66-26774# Technische Hogeschool, Eindhoven (Netherlands).
CONTRIBUTION TO THE STUDY OF THE STRUCTURE OF COAL: STUDY OF THE PRODUCT OF THE RAPID PYROLYSIS OF CARBON [CONTRIBUTION AUX RECHERCHES DE LA STRUCTURE DE LA HOUILLE: ETUDE DES PRODUITS DE LA PYROLYSE RAPIDE DU CHARBON]
Robert Simon Deelder (Ph.D. Thesis) [1966] 122 p refs In FRENCH
CFSTI: HC $4.00/MF $1.00

Elementary tar was obtained as a residue by the pyrolysis of coal, and some of its properties were studied as functions of temperature. This permitted a determination of the conditions under which the secondary reactions take place. The thermal degradation of coal was investigated as a complex sequence of reactions; the formation of free radicals following depolymerization constitutes the first stage. Certain generalized characteristics of the residue resemble those of the separated hydrocarbons, such as the index of aromaticity, mean number of condensed rings, and the ratio of oxygen to carbon. Other properties show the influence of petrographic inhomogeneity, including the ratio of hydrogen to carbon, and the distribution of hydrogen. Pentacyclic ring structures were also discovered. Physical studies of the tar showed its oligomerous character; the oxygen appears to catalyze the polymerization of the monomerous units. A distribution of monomerous units in the hydrogenate was established according to the number of rings and the degree of alkylation. Transl. by D.T.

N66-26818*# Stanford Research Inst., Menlo Park, Calif.
DEVELOPMENT OF MATERIAL SPECIFICATIONS AND QUALIFICATIONS OF POLYMERIC MATERIALS FOR THE JPL SPACECRAFT MATERIALS GUIDEBOOK Monthly Technical Progress Report No. 11, 10 Apr.–10 May 1966
Donald J. Lyman 15 May 1966 9 p Prepared for JPL
(Contract NAS7-100; JPL-450745)
(NASA-CR-75297) CFSTI: HC $1.00/MF $0.50 CSCL 11I

A determination is made of the outgassing characteristics of liquid and paste silicones and the effects of different post-curing procedures, in a program for the development of material specifications and qualifications of polymeric materials. Four representative silicone potting compounds were given a "space postcured" treatment by heating the samples in 150°C under a vacuum of 10^{-5} mm Hg for 24 hours. The samples began to give off large amounts of clear oil when the bath temperature reached 130°C to 140°C. After twenty-four hours, oil evolution had apparently ceased and the specimens were removed from the vacuum system, weighed, and then exposed to air for three days. The specimens were then submitted to thermal vacuum treatment under the usual conditions, with no detectable oil evolution from any of the samples. For this reason, it was concluded that the "space postcure" seems to be the most successful method for pretreatment of the silicone compounds. C.T.C.

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N66-25468# United Kingdom Atomic Energy Authority, Harwell (England). Theoretical Physics Div.
FINDING THE SHORTEST ROUTE BETWEEN TWO POINTS IN A NETWORK
T. A. J. Nicholoson Jan. 1966 16 p refs
(AERE-M-1700)

A new method is proposed for finding the shortest route between two points in an interconnected network. The shortest route is found by investigating a selection of routes from both the starting point and the point. The selection of routes is decided dynamically by extending one by one the routes which have currently covered the least distance. Once a complete through route has been found, it has to be made certain that

it is the minimum. The new method appears to be more efficient than alternative approaches to the problem through linear or dynamic programing. Some applications of the technique to scheduling and other problems are briefly described. Author

N66-25496# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
OPERATIONS RESEARCH VI Title Index
1965 54 p refs In DUTCH and ENGLISH
(TDCK-43746) CFSTI: HC $3.00/MF $0.50

A subject index is presented of titles announced in the Operations Bulletin of 1965. Titles are indexed according to queueing, programing, game, information, and inventory theory, as well as the theory of optimum distribution of effort. Other titles deal with military programs such as logistics, transportation, and weapon systems. Sections are also included on quality control, accountancy, medical problems, and miscellaneous topics. M.W.R.

N66-25641# France. Ministere de l'Air, Paris.
COLLOQUIUM ON NUMERIC CALCULATION AND APPLIED MATHEMATICS [COLLOQUE DE CALCUL NUMERIQUE ET MATHEMATIQUES APPLIQUEES]
Serv. de Doc. Sci. et Tech. de l'Armement, 1966 110 p refs In FRENCH Colloq. held at meeting of the Congr. de l'Assoc. Francaise pour l'Advan. des Sci., Rennes, France, 1963
(NT-148) CFSTI: HC $4.00/MF $0.75

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N66-25679# RAND Corp., Santa Monica., Calif.
EQUILIBRIUM PROCESSES
Sidney C. Port Mar. 1966 37 p
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4896-PR; AD-630343) CFSTI: HC $3.60/MF $0.50

Equilibrium processes of Markov processes on arbitrary state spaces are defined, and for certain subsets B of the state space we show that the strong law of large numbers and central limit theorem hold for (1) the total number of particles to visit B by time n, (2) the number of distinct particles to visit B by time n, and (3) the number of particles, which by time n leave B never to return. Author (TAB)

N66-25758# Joint Publications Research Service, Washington, D. C.
STUDIES IN APPLICATION OF MATHEMATICAL METHODS TO ECONOMICS
16 Feb. 1966 45 p refs Transl. into ENGLISH from Ekon. i Mat. Metody (USSR), Nov.–Dec. 1965 p 911–915, 940–958
(JPRS-34154; TT-66-30598) CFSTI: $2.00

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3. MULTIPROGRAMMING ON ELECTRONIC COMPUTERS N. S. Isayeva p 23–38 refs

N66-25768# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
A STOCHASTIC CHARACTERIZATION OF WEAR-OUT FOR COMPONENTS AND SYSTEMS
Z. W. Birnbaum (Washington Univ.), J. D. Esary, and A. W. Marshall Sep. 1965 26 p refs Also issued as TR-46 by Washington Univ. *Its* Math. Note No. 420
(Contract Nonr-477(38))
(DI-82-0460)

It is well known that the future life distribution of a device remains the same regardless of the time it was previously in use, if and only if the life distribution of that device is exponential. For this reason exponential life distributions are accepted as characterizing the phenomenon of no-wear. The problem of finding a class of life distributions which would similarly reflect the phenomenon of wear-out has been under investigation for some time. In answer to this problem we introduce in this paper the class of IHRA (Increasing Hazard Rate Average) distributions and show that it has, among others, the following optimal properties: (i) it contains the limiting case of no-wear, i.e., all exponential distributions, (ii) whenever components which have IHRA life distributions are put together into a coherent system, this system again has an IHRA life distribution, i.e., a system wears out when its components wear out, and (iii) the IHRA class is the smallest class with properties (i) and (ii). Author

N66-25830# Florida State Univ., Tallahassee. Dept. of Statistics.
PROPERTIES OF THE GENERALIZED SPRT BASED ON RANKS
I. Richard Savage and J. Sethuraman (Stanford Univ.) Aug. 1965 16 p refs
(Contract Nonr-989(13); Grant NSF GP-3836)
(FSU-M84; AD-623832) CFSTI: HC $1.00/MF $0.50

Let $(X_1, Y_1), (^*S_2, Y_2)$.... be independently and identically distributed bivariate random variables with a joint distribution H(...) which has continuous marginal distribution F(.) and G(.). The authors test the null hypothesis H_0: X,Y are independent, and G=F against the alternative hypothesis H_1: X,Y are independent, and G=F(A) where a>1 is a known constant. At the n(th) state of experimentation the available information is the ranks of $(Y_1,...Y_n)$ among $(X_1,...X_n,Y_1,...Y_n)$. Use is made of a sequential probability-ratio test based on ranks. If the distribution of (X,Y) is H(...) with marginals F(.) and G(.) and S(A,H)=S(A,F,G) does not equal 0 where S(A,F,G)=log

4A-2-integral log (F(x)+AG(x))(dF(x)) that this sequential test terminates with probability 1 and that the moment generating function of the required sample size is finite. TAB

N66-25863# RAND Corp., Santa Monica, Calif.
THE HEAWOOD MAP COLORING CONJECTURE
J. W. T. Youngs Mar. 1966 85 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4752-PR; AD-630090) CFSTI: HC $8.60/MF $0.75

The four color conjecture for a sphere is a famous unsolved problem, and the only information available today is that the chromatic number of a sphere is either four or five. On the other hand, it has been known for three quarters of a century that the chromatic number of a torus is seven. The memorandum is concerned with the chromatic number of orientable two-manifolds of positive genus. The problem is not completely solved, but considerable progress has been made in the past few years. This study reports on current results and, above all, on methods that have been employed. Author (TAB)

N66-25867# Michigan Univ., Ann Arbor. College of Literature, Science, and the Arts.
ON SOME CATEGORICAL ALGEBRA ASPECTS OF AUTOMATA THEORY: THE CATEGORICAL PROPERTIES OF TRANSITION SYSTEMS
Yehoshafat Give'on (Ph.D. Thesis) Feb. 1966 184 p refs
Its Rept.-03105-43-T
(Contract Nonr-1224(21); Grant DA-ARO(D)-31-124-G665)
(AROD-4049-19; AD-630257) CFSTI: HC $18.00/MF $1.00

The ubiquity and usefulness of homomorphisms in various studies of automata lead us to consider the following problem. What can be said on automata by referring only to homomorphisms of automata? In the report we present a study of this problem with respect to a special type of automaton, namely, with respect to transition systems. Categorical algebra methods are applied to the precise formulation of this problem and to its solution. We find that if W is a monoid belonging to a broad class of monoids, then the categorical abstract properties of transition systems with input W, are determined by the automorphisms of the monoid W. In particular, any property of automata without output is categorical if it does not depend on the particular labeling of the input alphabet. This study of the categorical properties of automata has two additional outcomes. First, we realize that categorical algebra methods can be applied to automata with arbitrary input monoids, with results pertinent to the theory of monoids. On the other hand, it indicates a possible usefulness in the study of automata, in particular, in getting a better understanding of the mathematical ideas employed in automata theory. In order to support this point of view with respect to automata theory, we show that many actually studied properties of automata are categorical. And we give an example of a categorical examination and formulation of a particular study of perfect automata. TAB

N66-25880# California Univ., Berkeley. Operations Research Center.
COMPACT BASIS TRIANGULARIZATION FOR THE BLOCK ANGULAR STRUCTURES Research Report
Romesh Saigal Jan. 1966 22 p refs
(Contract Nonr-222(83); Grant NIH GM-9606-05)
(ORC-66-1; AD-630120) CFSTI: HC $1.00/MF $0.50

Dantzig has shown (in AD-286 897) how a triangularized substitute inverse could be used in a staircase structured linear program. The present note is motivated by the same approach but applied to block angular structures. Block angular structures have special properties which can effectively be used to update the triangularized substitute inverse and the compact E-structure. The method of updating consists of performing a cyclic permution and a set of elementary operations on both the present T and the E-structure to obtain the new T and new E-structure. This paper presents the special properties and the method of updating. Author (TAB)

N66-25887# Florida State Univ., Tallahassee. Dept. of Statistics.
A NOTE ON THE RATIO OF STEADY STATE PROBABILITIES FOR ERGODIC MARKOV CHAINS
Vincent Hodgson 15 Sep. 1965 6 p ref
(Contract Nonr-988(08))
(M-91; ONR-TR-18; AD-623831) CFSTI: HC $1.00/MF $0.50

A new derivation is given of the result that the ratio of steady state probabilities P_j/P_i is equal to the expected number of times a Markov chain starting at state i is in state j before it returns to state i. Author (TAB)

N66-25891# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
POINTWISE BOUNDS FOR SOLUTIONS OF THE SECOND INITIAL-BOUNDARY VALUE PROBLEM FOR PARABOLIC EQUATIONS
V. G. Sigillito Nov. 1965 21 p refs
(Contract NOw-62-0604-c)
(TG-754; AD-630046) CFSTI: HC $2.60/MF $0.50

An extension is given of the method to obtain pointwise bounds for the solutions of the first initial boundary value problem for a semilinear parabolic equation. A method is given for obtaining interior pointwise bounds for solutions of the second initial boundary value problem. The bounds obtained are in terms of L^2 integrals of the initial boundary data; thus close bounds may be obtained, in the linear case, by applying the Rayleigh–Ritz technique. The approximating functions used in the procedure need not satisfy either the differential equation or the initial boundary data but only certain regularity conditions. Author

N66-25898# Florida State Univ., Tallahassee. Dept. of Statistics.
MONOTONICITY OF RANK ORDER LIKELIHOOD RATIOS
K. M. Lal Saxena Sep. 1965 51 p refs
(Contract Nonr-988(13))
(M-85; AD-623833) CFSTI: HC $3.00/MF $0.50

Suppose $X_1,...,X_m$; $Y_1,...,Y_n$ are mutually independent random variables. The X_i's and the Y_i's have the continuous distribution functions $F(x,\theta_1)$ and $F(x,_{x2})$ respectively. Denote the probability of the rank order z by $P_{\theta_1,\theta_2}(z)$. The notation zRz' denotes the following relationship: $z_i=z_i$ for all $i=1,...,N$ $(=m+n)$ except j and $k(j<k)$, $z_j=z'_k=0, z_k=z'_j=1$. If the interchange of components of z is only at the extreme ends, the relationship is denoted by zR*z'. Whenever zRz', the monotonicity of the rank order likelihood ratio $P_{\theta_1,\theta_2}(z)/P_{\theta_1,\theta_2}(z')$ is exhibited in θ_1 and θ_2 for (a) a Lehmann family, (b) a uniform family over $(0,\theta)$ and (c) one observation from one population and an arbitrary number of observations from the other population. In (c) only one population is assumed to belong to a family having m=1=r. Whenever zR*z, the monotonicity is exhibited when the families satisfy a special condition. This condition is satisfied by a normal and a logistic family. With m=n=2, the monotonicity is exhibited whenever zRz' for a normal logistic and a double exponential family. Two conjectures are given regarding the monotonicity of the rank order likelihood ratio. Author

N66-25926 Czechoslovak Academy of Sciences, Prague.
ASYMPTOTIC BEHAVIOUR OF MEASURE-VALUED BRANCHING PROCESSES
Miloslav Jirina 1966 61 p refs

This paper presents theorems on the asymptotic behavior of measure-valued branching processes. The measure-valued branching processes, or briefly M-processes, are Markov branching processes the states of which are non-negative measures on a given space S. The elements of S are called types and represent geometrical or physical or other characteristics of particles. This paper considers measures on M; basic properties of M-processes; asymptotic behavior in the cases $r<1$, $r=1$, and $r>1$; and M-processes with a finite number of types. R.N.A.

N66-25927# Boeing Scientific Research Labs., Seattle, Wash.
APPLICATION OF THE THEORY OF HORMANDER TO FINDING THE FUNDAMENTAL SOLUTION OF HYPERBOLIC LINEAR PARTIAL DIFFERENTIAL EQUATIONS
F. Edward Ehlers Dec. 1965 30 p refs *Its* Mathematical Note No. 442
(DI-82-0497; AD-629873) CFSTI: HC $2.00/MF $0.50

A procedure following the theory of Hormander is explained for finding the fundamental solution to a hyperbolic linear partial differential equation with constant coefficients. The relevant theorems concerning hyperbolic operators are reviewed and the fundamental solutions are derived for the one and the two dimensional wave equations, and for the equation of small disturbances propagating in a uniform subsonic or supersonic stream. By means of these examples, it is demonstrated that Hormander's theory provides a clear and valuable procedure for obtaining the fundamental solution and for defining the region of integration of the convolution integral solution to the inhomogeneous partial differential equation. By the appropriate choice of inhomogeneous term, the solution to the Cauchy problem for the plane of initial time is easily found for each of the three partial differential equations considered. Author (TAB)

N66-25944# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
INEQUALITIES FOR NONLOCAL PARABOLIC AND HIGHER ORDER ELLIPTIC EQUATIONS
K. Gustafson and V. Sigillito Dec. 1965 26 p refs
(Contract NOw-62-0604-c)
(TG-760; AD-630039) CFSTI: HC $2.60/MF $0.50

A general method is illustrated for obtaining L(2) bounds for nonlocal problems by using known bounds for corresponding strictly differential problems. The method is applied to obtain L(2) and pointwise bounds for perturbed second order parabolic and fourth order elliptic problems. Author (TAB)

N66-25945# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ERROR BOUNDS FOR APPROXIMATIONS TO EXPECTATION VALUES OF UNBOUNDED OPERATORS
Norman W. Bazley (Battelle Inst., Geneva) and David W. Fox Oct. 1965 17 p refs
(Contract NOw-62-0604-c)
(TG-739; AD-630037) CFSTI: HC $1.60/MF $0.50

A bound for the error between the expectation value of a self-adjoint operator B on the eigenfunction of a self-adjoint Hamiltonian H and the value given by an approximating vector, is obtained when H is a radial Schrodinger operator and B is multiplicative and unbounded. The analysis makes use of point and asymptotic estimates for the eigenfunction. TAB

N66-25957# RAND Corp., Santa Monica, Calif.
INTRODUCTION TO THE THEORY OF MATROIDS
W. T. Tutte Feb. 1966 114 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(R-448-PR; AD-478542)

The basic concepts and methods of matroid theory are presented. The Memorandum defines a matroid axiomatically and introduces the matroids associated with the structures of graphs and chain-groups. It discusses the subgraphs and contractions of a graph, exhibits corresponding simplifications of chain-groups and matroids, and studies the rank of a matroid. It also examines a property of matroids called connection and shows that it corresponds to the property of nonseparability for graphs. It further treats the detailed structure of a matroid (that is, it studies the relation between a given circuit and the rest of the matroid), and concludes by considering the regular matroids and their associated chain-groups. The regular matroids mark an interesting half-way stage between the matroids corresponding to graphs on the one hand, and the binary matroids, corresponding to chain-groups over GF(2), on the other. Author (TAB)

N66-26060# France. Ministere de l'Air, Paris.
PROCEEDINGS OF THE SECOND COLLOQUIUM ON NUMERICAL AND PHYSICAL CALCULUS [ACTES DU SECOND COLLOQUE DE CALCUL NUMERIQUE, CALCUL PHYSIQUE]
Serv. de Doc. Sci. et Tech. de l'Armement, 1965 109 p refs
Colloq. held at Paris, 18 May 1963 In FRENCH
(NT-147) CFSTI: HC $4.00/MF $0.75

CONTENTS:

1. APPLICATION OF OPERATIONAL CALCULUS TO THE ELECTRICAL RESISTANCE OF MATERIALS; NUMERICAL EXAMPLES Francisque Salles p 3-25
2. EXISTENTIAL PROBLEMS IN NONLINEAR ANALYSIS L. Derwidue p 27-36 refs
3. APPLICATIONS OF CERTAIN NUMERICAL CALCULATIONAL PROCESSES TO THE DETERMINATION OF THE RELATIVE RECTILINEAR MOTION OF A VISIBLE DOUBLE STAR S. Arend p 37-63 refs
4. SOME CONSIDERATIONS ON THE RESOLUTION OF THE PROBLEM OF INDIRECT MEASUREMENTS OF FINITE EXTENSIONS J. Dommanget p 65-74 refs
5. ON THE SUBJECT OF DOUBTFUL MEASUREMENTS J. R. Dath p 75-85 refs
6. APROPOS OF THE EXPLOITATION OF AN EXPERIMENTAL DOCUMENT BY THE CONDITION OF LEAST IMPRECISION P. Vernott p 87-92

N66-26070# California Univ., Berkeley. Operations Research Center.
REGENERATIVE METHODS IN SYSTEMS RELIABILITY
Benjamin Epstein Apr. 1966 30 p refs
(Grants NIH GM-9606(05); NSF GP-4593)
(ORC-66-12)

Three examples are given which show how a number of systems reliability problems can be treated rather simply when considered as giving rise to appropriate regenerative processes. The first example considers a one unit repairable system with time to failure c.d.f. $F(t)$, $t \geq 0$ and time to repair c.d.f. $G(t)$, $t \geq 0$. The second example considers a repairable system

consisting of n units, with the time to failure for i'th unit distributed with c.d.f. $F_i(t)=1-e^{-\lambda_i t}$, $t\geq 0$. In this example it is assumed that the system fails if any one of the n units fails, that only one unit can fail at a time, and that during the repair of the failed unit the (n−1) unfailed units cannot fail. It is also assumed that $G_i(t)$ is the c.d.f. of the time to repair the i'th unit. The third example examines the first passage time for E_2 into the failed state E_0 (where E_i, i=0,1,2..., is the state in which i units are good) for a two unit repairable system with general repair time c.d.f. G(t) and exponentially distributed unit times to failure. C.T.C.

N66-26082# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.

SOME INEQUALITIES FOR RELIABILITY FUNCTIONS

Z. W. Birnbaum (Washington Univ.) and J. D. Esary Oct. 1965 20 p refs *Its* Mathematical Note No. 431 (D1-82-0479)

For the class of coherent binary systems the inequality $h'(p)\geq h(p)[1-h(p)]/[p(1-p)]$ has been previously proven, where p=component reliability, h(p)=system reliability; hence h'(p) =rate of change of system reliability as a function of component reliability. In the present study essential improvements of this inequality are obtained under the assumption that n= number of components, and one or both of the following parameters are known: the "length" of the system, i.e. the smallest number of components such that their functioning assures the functioning of the system, and the "width" of the system, i.e. the smallest number of components such that if they fail the system must fail. The usefulness of these results is due to the fact that in practice n, length, and width are often known although the system is so complex that a study of some of its details for reliability purposes may be prohibitive. An immediate application of such inequalities is that when it is known that for component reliability p_0 the system has attained reliability $h(p_0)=p_0$, then a lower bound can be given for the system reliability h(p) for all $p\leq p_0$. Author

N66-26144# Joint Publications Research Service, Washington, D. C.

NECESSARY CONDITIONS OF THE EXTREMUM FOR ONE VARIATION PROBLEM WITH A DISTRIBUTION PARAMETER

G. I. Kostychev *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 153-165 refs (See N66-26126 14-01) CFSTI: $3.00

Based on a generalized theorem of a classic calculus of variation, further necessary conditions are introduced for the existence of the extremum for a one variation problem with a distribution parameter. Consideration is given to the theorem of implicit functions, the extremum existence, and the necessary conditions according to Weyerstrass, Legendre, and Jacobi. M.G.J.

N66-26289# Wisconsin Univ., Madison. Mathematics Research Center.

ON THE COMPUTATION OF CERTAIN FUNCTIONS OF LARGE ARGUMENT AND PARAMETER

P. Wynn Dec. 1965 60 p refs (Contract DA-11-022-ORD-2059) (MRC-608; AD-630541) CFSTI: HC $3.00/MF $0.75

The derivation of an asymptotic series for a certain class of functions is described; the process is mechanized for use with a digital computer. Author (TAB)

N66-26294# California Univ., Berkeley. Operations Research Center.

GAMES OF SEQUENCE PREDICTION

David William Matula Feb. 1966 65 p refs (Contracts Nonr-222(83); DA-31-124-ARO(D)-331) (ORC-66-3; AROD-5307-8; AD-630619) CFSTI: HC $6.60/MF $0.75

Contents: Introduction; Emission prediction games; Partial sum bounded sequences and distribution bounded densities; Value of emission prediction game with self disjoint list; Optimal emittor strategies; Emission prediction games with overlapping lists; and Extensions and implications of the theory. TAB

N66-26295# System Development Corp., Santa Monica, Calif.

STOCHASTIC DUELS WITH HOMING

Trevor Williams 18 May 1965 35 p refs (SP-1017/106/00; AD-617773) CFSTI: HC $2.00/MF $0.50

Duels where both marksmen 'home' or 'zero in' on one another are here considered, and the effect of this on the win probability is determined. It is proved generally that if the over-all hit probability is fairly and naturally defined, the only possible result of homing must be to worsen a duelist's performance. Next it is shown that a negative binomial distribution of conditional hit probability over rounds exhibits the effect of homing and leads to win probabilities that can be straightforwardly evaluated. Maximum-likelihood estimation of the hit probability and homing from field data is outlined. The solutions of the duels are displayed as contour maps. Author (TAB)

N66-26314# Wisconsin Univ., Madison.

THE EXISTENCE OF A GLOBAL CLASSICAL SOLUTION OF THE INITIAL-BOUNDARY VALUE PROBLEM FOR $(D_t^2-\Delta)u+u^3=f$

Jerome Sather Nov. 1965 32 p refs (Contract DA-11-022-ORD-2059) (MRC-585; AD-630528) CFSTI: HC $2.00/MF $0.50

The non-linear hyperbolic equation $\Box u+u^3=f$ has been the object of considerable interest to mathematicians and physicists in the last four years. The principal result in this paper is an existence theorem guaranteeing a global classical solution of the initial-boundary value problem for this equation. Author (TAB)

N66-26315# Wisconsin Univ., Madison. Mathematics Research Center.

GENERAL EXISTENCE CRITERIA FOR THE INVERSE OF AN OPERATOR

A. M. Ostrowski Jan. 1966 7 p refs (Contract DA-11-022-ORD-2059) (MRC-619; AD-630749) CFSTI: HC $1.50/MF $0.50

A new bound is given for the perturbation of a nonsingular operator conserving its nonsingularity. Author (TAB)

N66-26316# Wisconsin Univ., Madison. Mathematics Research Center.

ON EUCLIDEAN SETS HAVING ONLY TWO DISTANCES BETWEEN POINTS

S. J. Einhorn and I. J. Schoenberg Mar. 1966 39 p refs (Contract DA-11-022-ORD-2059) (MRC-621; AD-630751) CFSTI: HC $3.60/MF $0.50

A set of n points of the euclidean k-dimensional space is called 2-valued provided that the distances between its points assume at most two positive values. It is shown that if n> or =k+2 and k is fixed, then only a finite number of such sets exist. All of these are determined for the plane (k=2) and for space (k=3). Author (TAB)

N66-26319# Wisconsin Univ., Madison. Mathematics Research Center.
CONTINGENCY TABLES: A REVIEW
Marvin A. Kastenbaum Sep. 1965 42 p refs Presented at Gordon Res. Conf. on Statist. in Chem. and Chem. Eng., New Hampton, N. H., 14 Jul. 1965
(Contract DA-11-022-ORD-2059)
(MRC-596; AD-630533) CFSTI: HC $2.00/MF $0.50

This report is primarily a review of the elementary principles and recent literature on contingency tables. TAB

N66-26320# Wisconsin Univ., Madison. Mathematics Research Center.
THE CAUCHY PROBLEM FOR GENERAL SYSTEMS OF LINEAR PARTIAL DIFFERENTIAL EQUATIONS
S. A. Halpern (Ph.D. Thesis) Feb. 1966 22 p refs Transl. into ENGLISH from Usp. Mat. Nauk (Moscow), v. 18, p 239-249
(Contract DA-11-022-ORD-2059)
(MRC-613; AD-630547) CFSTI: HC $1.00/MF $0.50

The work is a review of the author's doctoral dissertation published in Uspekhi Mat. Nauk, 18, pp 239-249. Author (TAB)

N66-26335# Wisconsin Univ., Madison. Mathematics Research Center.
THE ANALYTIC CONTINUATION OF THE RESOLVENT KERNEL AND SCATTERING OPERATOR ASSOCIATED WITH THE SCHROEDINGER OPERATOR
C. L. Dolph, J. B. Mc Leod, and D. Thoe Feb. 1966 36 p refs
(Contract DA-11-022-ORD-2059)
(MRC-606; AD-630540) CFSTI: HC $2.00/MF $0.50

We consider the Schroedinger equation $\Delta\psi+[\lambda-q(x)]\psi=0$ in three dimensions, where the potential q(x) is locally L^2, Hoelder continuous except at a finite number of points and $O(e^{-\alpha|x|})$ as $|x|\to\infty$, $\alpha>0$. The object of the paper is to show under these conditions that the Green's function associated with the equation can be continued analytically from its usual domain of definition $\mathrm{im}\,\kappa>0$ ($\kappa=\sqrt{\lambda}$) into the "non-physical sheet" $\mathrm{im}\,\kappa<0$. The continuation is in fact carried through to $\mathrm{im}\,\kappa>-1/2\alpha$ and the resulting function is shown to be meromorphic. A similar investigation is made for the scattering operator associated with the equation, and it is shown that this has an analytic continuation through $|\mathrm{im}\,\kappa|<1/2\alpha$. Some examples are given. Author

N66-26336# Wisconsin Univ., Madison. Mathematics Research Center.
RECENT TRENDS IN MULTIVARIATE PREDICTION THEORY
P. Masani Jan. 1966 58 p refs
(Contract DA-11-022-ORD-2059)
(MRC-637; AD-630756) CFSTI: HC $3.00/MF $0.75

The paper surveys the present state of the theory of linear, least squares prediction of q-variate weakly stationary stochastic processes with discrete time. The emphasis is on logical order. Hence recent developments are described within the context of a general theory rather than chronologically. Methods for computing the predictor are briefly discussed, but purely statistical questions such as the estimation of covariances are omitted. Author (TAB)

N66-26337# Wisconsin Univ., Madison. Mathematics Research Center.
NOTE ON THE GENERALIZED INVERSE OF A MATRIX PRODUCT
T. N. E. Greville Jan. 1966 9 p refs
(Contract DA-11-022-ORD-2059)
(MRC-623; AD-630752) CFSTI: HC $1.10/MF $0.50

Let A (+) denote the Moore-Penrose generalized inverse and A (*) the conjugate transpose of a matrix A. Several necessary and sufficient conditions are obtained for (AB (+)= B(+) A(+) (where A(+) is the Moore-Penrose inverse of A), and the structure of matrices A and B satisfying this equation is examined. TAB

N66-26338# Sylvania Electric Products, Inc., Waltham, Mass. Applied Research Lab.
AN ADAPTIVE HYPERSPHERE DECISION BOUNDARY Interim Report
Paul W. Cooper Griffiss AFB, N. Y., RADC, Mar. 1966 29 p refs
(Contract AF 30(602)-3619)
(RR-492; RADC-TR-66-65; AD-631083) CFSTI: HC $2.60/MF $0.50

It was previously shown that the hypersphere decision boundary optimally partitions an n-dimensional sample space when the underlying category probability distributions are of certain types, including spherically symmetric normal and Pearson Types II and VII. Such a model could apply to pattern recognition or to detection of band-limited white stochastic signals. The hypersphere partition arises for distributions differing in their means and in their variances. This paper examines the problem of adaptation, and treats the following two topics: non-supervised adaptation to the optimum hypersphere for normal distributions; supervised estimation of the Pearson shape parameter m, thereby supplementing the partial treatment of estimation in an earlier hypersphere paper. Author (TAB)

N66-26350# Wisconsin Univ., Madison. Mathematics Research Center.
CONVERGENCE OF THE NEWTON PROCESS TO MULTIPLE SOLUTIONS
L. B. Rall Feb. 1966 38 p refs
(Contract DA-11-022-ORD-2059)
(MRC-617; AD-630747) CFSTI: HC $3.60/MF $0.50

The slow convergence of Newton's method to multiple solutions of scalar and finite systems of equations is characterized, and a corrected Newton procedure having quadratic convergence is developed. The results are extended to a class of nonlinear operator equations. Author (TAB)

N66-26351# Wisconsin Univ., Madison. Mathematics Research Center.
CONTRIBUTIONS TO THE THEORY OF THE METHOD OF STEEPEST DESCENT I
A. M. Ostrowski Mar. 1966 35 p
(Contract DA-11-022-ORD-2059)
(MRC-615; AD-630748) CFSTI: HC $3.60/MF $0.50

A study of the derived set of a sequence of points, obtained by the method of steepest descent. Author (TAB)

N66-26353# Wisconsin Univ., Madison. Mathematics Research Center.
ON TURNING POINT PROBLEMS FOR SYSTEMS WITH ALMOST DIAGONAL COEFFICIENT MATRIX
Wolfgang Wasow Feb. 1966 52 p refs
(MRC-612; AD-630546) CFSTI: HC $3.00/MF $0.50

A holomorphic n-by-n system $\epsilon dy/dx = A(x,\epsilon)y$, with $A(x,0) = x\hat{A}(x)$, $\hat{A}(x)$ diagonal with distinct eigenvalues, in $|x| \leq x_0$, is reduced to the simpler form $\epsilon dz/dx = x\hat{A}(x) + \epsilon\hat{B}(\epsilon)$. If n=2, the simplified equation is completely solved, near x=0, by uniformly valid asymptotic series. Author

N66-26383# Wisconsin Univ., Madison. Mathematics Research Center.
AN APPLICATION OF REPRESENTATIONS FOR THE GENERALIZED INVERSE OF A MATRIX
Randall E. Cline Sep. 1965 26 p refs
(Contract DA-11-022-ORD-2059)
(MRC-592; AD-630531) CFSTI: HC $2.00/MF $0.50

Generalized inerse representations are developed for solutions of the matrix equations AXA=A and XAX=X. It is shown that both the Scroggs-Odell pseudoinverse of a matrix and the Drazin pseudoinverse of a matrix with index one follow as special cases. Representations for the Drazin pseudoinverse of a matrix with index greater than one are also developed. Author (TAB)

N66-26385# Wisconsin Univ., Madison. Mathematics Research Center.
THE NUMBER OF INTEGRABLE-SQUARE SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS
J. B. Mc Leod Oct. 1965 13 p refs
(Contract DA-11-022-ORD-2059)
(MRC-578; AD-630525) CFSTI: HC $1.00/MF $0.50

This report gives an example in which a formally self-adjoint ordinary differential operator, of even order and with complex coefficients, has its two deficiency indices different. Author (TAB)

N66-26426# Wisconsin Univ., Madison. Mathematics Research Center.
NEUTRALIZED VALUES. 1: INTRODUCTION
J. G. van der Corput Jan. 1966 44 p refs
(Contract DA-11-022-ORD-2059)
(MRC-614; AD-630548) CFSTI: HC $2.00/MF $0.50

Starting from a given fundamental set by means of neutrices new mathematical objects 'Neutralized Values' are introduced. The relations between these objects form a new analysis (neutrix calculus), which comprises not only the classical analysis, but infinitely many other calculi, such as that of the generalized functions and the operational calculus. Each of these calculi has a certain structure by which the calculus is determined. In the special neutrix calculus only neutralized values are admitted which are equal to an element of the fundamental set. The general neutrix calculus yields results outside the fundamental analysis. The introduction treats the neutrices, the neutralized values, the structures, the operators, the pseudo operators, Hadamard neutrices, and some Laplace transforms. The following reports under the overall title 'Neutralized Values' will treat applications of the theory developed in this introduction. Author (TAB)

N66-26427# Wisconsin Univ., Madison. Mathematics Research Center.
ON BESSEL POLYNOMIALS
F. M. Ragab Jan. 1966 11 p refs
(Contract DA-11-022-ORD-2059)
(MRC-584; AD-630527) CFSTI: HC $1.00/MF $0.50

New representations of the Bessel polynomials are given. Author (TAB)

N66-26433# Wisconsin Univ., Madison. Mathematics Research Center.
ON STABILITY OF LINEAR SMOOTHING FORMULAS
T. N. E. Greville Mar. 1966 25 p refs
(Contract DA-11-022-ORD-2059)
(MRC-611; AD-630545) CFSTI: HC $1.00/MF $0.50

A proof is given of Schoenberg's conjecture that 'least-square' smoothing is stable, and is extended to include the entire class of minimum R_m smoothing formulas. Minimum R_∞ formulas are defined and studied. Author (TAB)

N66-26493# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ROUTINE FOR IMPROVING THE ACCURACY OF THE ROOTS OF POLYNOMIALS WITH REAL COEFFICIENTS
Alene K. Depue Aug. 1965 39 p refs
(BRL-MR-1687; AD-629042) CFSTI: HC $2.00/MF $0.50

A routine has been developed to compute the real and complex conjugate roots for a polynomial with real coefficients. When the polynomial is of odd degree, the routine locates one real root and then reduces the polynomial to an even degree. The remainder of the roots are located in pairs by using factors and Bairstow's Algorithm. There is no special provision to detect multiple roots and hence the routine may fail or converge to incorrect values. Computing roots of polynomials related to the Transient Response of a Visco-elastic Torsional Pendulum illustrated the effect that small errors in computed roots have on subsequent computations. A need arose to eliminate as many errors as possible. The routine tries to eliminate most errors in extracting roots by: scaling; using equations yielding least error; refining extracted roots, both real and imaginary, to a prescribed accuracy by the Newton-Raphson Method. Other error checks are included to achieve as much accuracy as possible. Several examples are included. Author (TAB)

N66-26517# Purdue Univ., Lafayette, Ind. Div. of Mathematical Sciences.
SEMI-REGULAR FUNCTIONS IN MARKOV CHAINS
Paul T. Holmes Feb. 1966 48 p refs *Its* Mimeograph Series No. 62
(Contract AF 33(657)-11737)
(AD-630837) CFSTI: HC $4.60/MF $0.50

Some properties of a discrete parameter Markov chain are studied. General properties of super regular functions and measures are established. Theorems discussing super regular functions and measures on recurrent classes are proved, a new proof of a theorem characterizing nonrecurrent classes is given, and a theorem which characterizes a nonrecurrent class in terms of the existence of a super regular measure possessing a simple property is proved. In addition, an equitable class of states is shown to be one on which all super regular functions and measures are constants. A study of nondissipative chains, i.e., those chains in which almost every path function

eventually enters the set of positive recurrent states, is presented. Proofs of previously published theorems on nondissipative chains are given. Certain sets of states called sojourn sets and almost closed sets, which are of interest in the study of the asymptotic behavior of the path functions, are discussed. General properties of these sets are established and their relation to super regular functions is demonstrated. Author

N66-26518# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.
QUASI-EQUILIBRIA IN MARKETS WITH NON-CONVEX PREFERENCES
Ross M. Starr 28 Mar. 1966 27 p refs
(Contract Nonr-225(50))
(TR-141; AD-630627) CFSTI: HC $2.60/MF $0.50

An upper bound is placed on social divergence from general equilibrium, due to non-convexity of the traders' preference relations. Existence and significance of certain quasi-equilibria are investigated. If there is a sufficiently large number of traders in the market, the existence of a configuration arbitrarily close to equilibrium is demonstrated. Author (TAB)

N66-26519# Stanford Univ., Calif. Dept. of Statistics.
LIMIT DISTRIBUTIONS OF THE MINIMAX OF INDEPENDENT IDENTICALLY DISTRIBUTED RANDOM VARIABLES
Herman Chernoff and Henry Teicher 15 Apr. 1964 32 p refs
(Contract Nonr-225(72))
(TR-50; AD-600005) CFSTI: $0.50

The class of limiting distributions of the normalized minimax (or maximin) of independent identically distributed random variables is obtained and the domains of attraction of the three limiting types are characterized. Asymptotic independence of the minimax and maximin is also demonstrated. Author (TAB)

N66-26520# Stanford Univ., Calif. Dept. of Statistics.
OPTIMAL GROUP TESTING
Milton Sobel 10 Jul. 1964 54 p refs
(Contract Nonr-225(53))
(TR-72; AD-607063) CFSTI: HC $3.00/MF $0.75

The paper concerns the devising of a sequential scheme which minimizes the expected number of tests required to classify all of the N units as good or bad. TAB

N66-26521# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ON VAN DER CORPUT DIFFERENTIAL SYSTEMS
John E. Weidlich, Jr. Jan. 1966 116 p refs
(Contract Nonr-222(37); Grants NSF G-1884; NSF GP-2570)
(LMSC-6-76-66-1; AD-626761) CFSTI: HC $4.00/MF $0.75

The differential system is defined as a first order, nonlinear system where the independent variable and the dependent vector are real. Each component of the tangent field is real and denotes a linear combination with complex coefficients. A subset of the real vector space is described. The principal object is to investigate the asymptotic behavior at infinity of the solutions of special classes of these systems. The properties specifying these classes are included. Theorems are developed, and the error terms are discussed. N.E.N.

N66-26537# Stanford Research Inst., Menlo Park, Calif.
FURTHER RESULTS ON SUBDIRECTLY IRREDUCIBLE UNARY ALGEBRAS Scientific Report No. 5
Michael Yoeli 15 Jan. 1966 15 p refs
(Contract AF 19(628)-5092)
(AFCRL-66-66; AD-630304) CFSTI: HC $1.60/MF $0.50

Irreducibility conditions for non-connected unary algebras are established. Irreducible representations of unary algebras are demonstrated to be non-unique and a computational method for obtaining an irreducible representation of an arbitrary basic algebra is derived. Furthermore, the concept of decomposability is introduced and related to that of reducibility. A unary algebra is decomposable if it can be non-trivially represented as the homomorphic image of a subalgebra of the direct product of two other unary algebras. Author (TAB)

N66-26559# Stanford Univ., Calif. Dept. of Statistics.
ASYMPTOTIC DISTRIBUTION OF LINEAR COMBINATIONS OF FUNCTIONS OF ORDER STATISTICS WITH APPLICATIONS TO ESTIMATION
Herman Chernoff, Joseph L. Gastwirth, and M. V. Johns, Jr.
18 Oct. 1965 44 p refs
(Contract Nonr-225(53))
(TR-85; AD-623862) CFSTI: HC $2.00/MF $0.50

A method is described for finding asymptotically optimal linear combinations of order statistics for estimating location and scale parameters in both the uncensored and censored data cases. Theorems are obtained concerning the conditions under which statistics of a specified form are asymptotically normally distributed. These theorems are applied to the problem and it is shown that the covariance matrix of the asymptotic normal distribution of the estimators coincide with the bounds given by the inverse of an information matrix. Several examples are discussed briefly. H.S.W.

N66-26577# RAND Corp., Santa Monica, Calif.
CONTRACTION MAPPINGS IN THE THEORY UNDERLYING DYNAMIC PROGRAMMING
Eric V. Denardo Mar. 1966 32 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4755-PR; AD-629920) CFSTI: HC $3.60/MF $0.50

This memorandum is concerned with the formulation and analysis of a broad class of optimization problems including many, but not all, dynamic programming problems. The formulation generalizes those of several authors and provides further insight into the class of problems which satisfy Bellman's Principle of Optimality. Three widely shared properties of optimization problems are abstracted; they are called 'contraction,' 'monotonicity,' and 'N-stage contraction' properties. Analysis is conducted of those classes of problems satisfying the first property, the first two properties, and the last two properties. In each case, a fixed-point argument guarantees that a functional equation have a unique solution; in the latter two cases that solution is the optimal return function. Policies whose return functions attain or approximate the fixed point are shown to exist, and three techniques for determining such policies are presented. The techniques are successive approximations, mathematical programming, and a generalization of one of Howard's policy improvement routines. Certain issues concerning history-remembering decision procedures and stationary processes are settled. Examples are provided, and apparent integrability issues in some of them are circumvented. Author (TAB)

N66-26597# System Development Corp., Santa Monica, Calif.
A NOTE ON PUSHDOWN STORE AUTOMATA AND REGULAR SYSTEMS Scientific Report No. 2
Sheila A. Greibach 31 Aug. 1965 17 p refs
(Contract AF 19(628)-5166)
(AFCRL-65-861; TM-738/016/00; AD-628203) CFSTI: HC $1.00/MF $0.50

A theorem of Bar-Hillel, Perles, and Shamir is used to show that the set of tapes left on the pushdown store by a regular set is regular. As a consequence, one obtains a generalization of a theorem of Buchi. Author (TAB)

N66-26600# David Taylor Model Basin, Portsmouth, Va. Structural Mechanics Lab.
A METHOD TO CORRECT RECORDS FROM DISTRIBUTED PARAMETER VELOCITY TRANSDUCERS FOR HIGH FREQUENCY RESONANCE DISTORTIONS
C. E. Stewart Jan. 1966 20 p refs
(DTMB-1984; AD-630115) CFSTI: HC $1.00/MF $0.50

A correction method devised to compensate for the high frequency distortions introduced by the mechanical characteristics of the commonly used two-coil bar-magnet velocity meter is considered. The application of the correction to both digital and analog data reduction procedures is discussed and illustrated. The correction can be applied more simply with automatic sampled data systems for the applications illustrated. The illustrations also show that a good correction is obtained to at least the first longitudinal mode frequency of the coil form. The delay method of signal correction has the advantage over conventional filtering techniques in that it introduces no phase distortion and is capable of compensating for very high magnification factors. Author (TAB)

N66-26618# Wisconsin Univ., Madison. Mathematics Research Center.
QUADRATURE METHODS OF ARBITRARY ORDER FOR SOLVING LINEAR ORDINARY DIFFERENTIAL EQUATIONS
J. T. Day Jan. 1966 21 p refs
(Contract DA-11-022-ORD-2059)
(MRC-635; AD-630755) CFSTI: HC $1.00/MF $0.50

The writer shows that given any positive integer n there is a one step method for numerical integration of the linear ordinary differential equation $Y' = AY + B$ of order n+1. Three numerical examples indicate that the method is quite successful for the cases n=3 and n=4. Author (TAB)

N66-26620# Wisconsin Univ., Madison. Mathematics Research Center.
PROPERTIES OF DIFFERENTIAL FORMS IN N REAL VARIABLES
H. B. Mann, Josephine Mitchell, and Lowell Schoenfeld Nov. 1965 9 p refs
(Contract DA-11-022-ORD-2059)
(MRC-598; AD-630535) CFSTI: HC $1.00/MF $0.50

A result of Mann for harmonic forms in 2 real variables is generalized to more variables and to homogeneous elliptic operators of the second order with constant coefficients. TAB

N66-26621# Wisconsin Univ., Madison. Mathematics Research Center.
THE PROBLEM OF SINGULAR PERTURBATIONS OF LINEAR ORDINARY DIFFERENTIAL EQUATIONS AT REGULAR SINGULAR POINTS
D. L. Russell and Y. Sibuya Sep. 1965 71 p refs
(Contract DA-11-022-ORD-2059; Grant NSF GP-2280)
(MRC-580; AD-630526) CFSTI: HC $3.00/MF $0.75

This paper studies a system of linear ordinary differential equations $\epsilon^{\sigma} x(dy/dx) = A(x,\epsilon)y$, where $A(x,\epsilon)$ is holomorphic in a domain $\{(x,\epsilon) \mid |x| \leq x_0, |\epsilon| \leq \epsilon_0\}$. The principal results is a complete asymptotic theory of the system when x=0 is not a transition point. Also obtained are block diagonalization and block-triangularization theorems which reduce the order of the system when the lead matrix (A(0,0) has at least two distinct eigenvalues. Author

N66-26624# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE MODULI OF ZEROS OF DERIVATIVES OF POLYNOMIALS
A. M. Ostrowski Mar. 1966 18 p refs
(Contract DA-11-022-ORD-2059)
(MRC-624; AD-630753) CFSTI: HC $1.60/MF $0.50

Relations are established between the moduli of the zeros of a polynomial and those of its derivative. Author (TAB)

N66-26652*# Midwest Research Inst., Kansas City, Mo.
ANALYSIS OF THE COUPLED FREQUENCIES AND MODE SHAPES OF VEHICLE CONTROL SYSTEMS Final Report, 15 Apr. 1965-14 Apr. 1966
Yudell L. Luke and Rosemary Moran 19 Apr. 1966 52 p refs
(Contract NAS8-20139; MRI Proj. 2866-P)
(NASA-CR-75114) CFSTI: HC $3.00/MF $0.50 CSCL 12A

In the design of missile control systems, an analysis of the coupled frequencies and mode shapes leads to the study of the generalized eigenvalue problem D(s)x=0 where D(s) is an nxn matrix whose elements are polynomials in s and x is a vector. In this report, we develop a systematic procedure for the evaluation of s and the corresponding vector x. A FORTRAN II-D program for the IBM 1620 computer is appended to produce the complete solution. A numerical example is provided. Author

N66-26675# Stanford Univ., Calif. Dept. of Statistics.
MULTIPLE REGRESSION AND ESTIMATION OF THE MEAN OF A MULTIVARIATE NORMAL DISTRIBUTION
Alvin J. Baranchik 4 May 1964 44 p refs
(Contract Nonr-225(72))
(TR-51; AD-600421)

Two problems are presented in this study: estimation of the mean vector of a multivariate normal random variable, and estimating the regression function in the case of one predictand and at least three predictors. Estimators are given which have strictly lower risks than the corresponding maximum likelihood estimators for the following three problems: (a) estimation of the regression function; (b) estimation of the regression coefficients; and (c) estimation of the mean of the predictand when the means of the predictor variables are known. In each of the problems it is assumed that there are at least three predictor variables. A summary of previously known results for these three problems is given. The report concludes with some elementary modifications of the estimators computed earlier in the report. The author remarks that these modified estimators will frequently be of practical use. TAB

N66-26678# RAND Corp., Santa Monica, Calif.
LIMIT THEOREMS FOR TRANSIENT MARKOV CHAINS
Sidney C. Port Apr. 1966 40 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4965-PR; AD-630944) CFSTI: HC $3.60/MF $0.50

We investigate the asymptotic behavior, for large n, of the quantities $P_x(n<V_B^r<\infty;\ X_{V_B^r}=y)$, where V_B^r is the time of the r-th visit to a finite, nonempty set B of states in a countable state space transient Markov chain X_n. These results are shown to yield information on the asymptotic behavior for solutions to the exterior Dirichlet problem for B, and on the error in approximating $P_x(N_n(B)\leq r)$ by $P_x(N(B)\leq r)$, where $N_n(B)$ is the occupation time in B by time n and $N(B)=\lim_n N_n(B)$. Applications are given to several specific classes of Markov chains. Author

N66-26683# Air Force Cambridge Research Labs., Bedford, Mass. Solid State Sciences Lab.

ON THE THEORY OF BOOLEAN FORMULAS: SHORTEST AND PRIME FORMULAS

E. W. Samson and L. Calabi (Parke Mathematical Labs., Inc.) Feb. 1966 25 p refs *Its* Phys. and Mathematical Sci. Res. Papers No. 195

(AFCRL-66-101; AD-631074) CFSTI: HC $1.00/MF $0.50

The notion of prime implicant is defined and studied at a high level of generality. All the usual results are preserved and deepened and some new ones obtained. Paramount are those relating prime implicants and shortest sums. This theoretical development may be applied to the minimization of Boolean formulas built from formulas of an arbitrarily given set S (for example, the set of formulas realized by devices of a particular kind) and representing a given incomplete switching function. Several computational processes are briefly discussed. The general theory is supplemented by results particular to the 'classical' case in which S is the set of the products of literals. Author (TAB)

N66-26710# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

AN APPROACH TO THE CONSOLIDATION OF SNOW

E. D. Feldt and G. E. H. Ballard Dec. 1965 20 p refs

(CRREL-RR-181; AD-630648) CFSTI: HC $1.60/MF $0.50

A consolidation theory is developed for an age-hardened snow under uniaxial stress in the porosity range of 35 to 55% by considering one mechanism, viz., viscous flow of interparticle bonds. For a uniaxial stress σ, the differential equation for porosity n in terms of time t is shown to be $1/(1-n)\ dn/dt=\nu\sigma n/\eta$ (1-an) where a and ν are structural parameters and η is the coefficient of viscosity of ice. Comparison of this equation and the integrated form with existing data predicts consistent and reasonable values for a. The predicted values of η/ν range from 10^{-2} to 10^{2} times the published values for η, which may indicate that ν, and hence the consolidation rate, is greatly affected by the diagenetic history of the snow and the conditions of experimentation. Author (TAB)

N66-26832# Wisconsin Univ., Madison. Mathematics Research Center.

EIGENFUNCTION EXPANSIONS IN BANACH SPACES

R. E. L. Turner Jan. 1966 31 p refs

(Contract DA-11-022-ORD-2059)

(MRC-600; AD-630536) CFSTI: HC $2.00/MF $0.50

It is shown that the property of being a basis in a reflexive Banach space for a set of vectors, in particular the eigenfunctions of an unbounded operator, is preserved under certain perturbations. As an application the author shows that a large class of 2nd order differential operators with operator valued coefficients have bases of eigenfunctions in L(p) (0,1), $1<p<\infty$. Author (TAB)

N66-26836# Iowa State Univ. of Science and Technology, Ames.

RESEARCH ON ANALYSIS OF VARIANCE AND RELATED TOPICS Final Technical Report

G. Zyskind, O. Kempthorne, R. F. White, E. E. Dayhoff, and T. E. Doerfler Wright-Patterson AFB, Ohio. ARL, Nov. 1964 223 p refs

(Contract AF 33(616)-8269)

(ARL-64-193; AD-612035) CFSTI: HC $6.00/MF $1.25

The research described in this report is directed towards understanding of linear models and the analysis of variance with regard to experimentation. Chapter I gives a general outline of topics covered in the report. Chapter II gives a detailed account of the randomization consequences in a generalization of the balanced incomplete block design. Chapter III attempts a unified formulation of experimental structures and discusses variance analysis in the general experiment. Chapter IV introduces generalized polykays and discusses their application to the obtaining of variances and covariances of components of variation. Chapter V discusses and relates various topics in linear models. Chapter VI discusses the size and power of certain tests under experimental randomization. TAB

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N66-25399# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).

DIVISION OF METEOROLOGICAL PHYSICS ANNUAL REPORT 1964-65

1965 37 p refs

CFSTI: HC $2.00/MF $0.50

Research on the fundamental processes of meteorology, and the application of this knowledge to economic problems in Australia are defined as the main study objectives. Attention is focused primarily on the basic problems of atmospheric mechanics, and on agricultural meteorology and the efficient use of water. Results are summarized of studies on the general circulation, including vertical momentum flux, the southern oscillation, and Antarctica and the heat balance; general micrometeorology and evaporation; radiometer instrumentation; upper atmosphere observations of the vertical distribution of ozone, and radioactivity; lysimeter installations; transpiration reduction; and blue mold in tobacco. M.G.J.

N66-25616# Geophysics Corp. of America, Bedford, Mass. Technology Div.

ATMOSPHERIC TRANSPORT OF ROCKET MOTOR COMBUSTION BY-PRODUCTS. VOLUME III: DATA SUPPLEMENT Final Report

H. L. Hamilton, Jr. Dec. 1965 185 p

(Contract N123(61756)34567(PMR))

(AD-630206) CFSTI: HC $5.00/MF $1.25

Volume III contains a comprehensive compilation of the meteorological and diffusion measurements obtained during the field studies. Author (TAB)

N66-25624# Army Chemical Center, Edgewood, Md.
THE APPARENT DEPENDENCE OF TERRESTRIAL SCINTILLATION INTENSITY UPON ATMOSPHERIC HUMIDITY Technical Report, Sep. 1963–Mar. 1965
Hugh R. Carlon Nov. 1965 35 p refs
(CRDLR-3324; AD-630117) CFSTI: HC $2.00/MF $0.50

Observations indicate a direct relationship between terrestrial scintillation intensity and relative humidity (RH). A developed theory supplementing air-refractive and diffractive treatments attributes this increased modulation intensity to water droplets formed either gradually or instantaneously at 70% RH or higher. Modulation at visible wavelengths is attributed to scattering, while spectral absorption causes far-infrared-wavelength modulation. The report contains limited experimental substantiation of this theory. A comparative discussion of atmosphere opacity at far-infrared wavelengths (10-micron region) under high- and low-humidity conditions is presented. An empirical equation for determination of the 'scintillation intensity index' is presented, with graphical presentations of conclusions. Author (TAB)

N66-25633# Weapons Research Establishment, Salisbury (Australia).
REPORT ON THE CONDUCT OF CLEAR AIR TURBULENCE TRIALS IN AUSTRALIA, JULY–OCTOBER 1963
T. F. Dalton-Morgan and C. K. Rider (Aeron. Res. Labs., Melbourne) Jan. 1966 34 p refs
(WRE-TRD-18) CFSTI: HC $2.00/MF $0.50

This report covers a series of trials mounted to search for and measure clear air turbulence over the Australian Continent. It includes an outline of the experimental meteorological forecasting techniques used. A description is also given of the special soundings taken at Woomera during the passage of major weather disturbances which occurred during the conduct of the clear air turbulence trials. Author

N66-25669# Geophysics Corp. of America, Bedford, Mass. GCA Technology Div.
ATMOSPHERIC TRANSPORT OF ROCKET MOTOR COMBUSTION BY-PRODUCTS. VOLUME II: EXPERIMENTAL DESIGN AND FIELD INSTALLATION Final Report
H. E. Cramer, H. Hamilton, and G. De Santo Dec. 1965 47 p refs
(Contract N123(61756)34567(PMR))
(AD-630261) CFSTI: HC $4.60/MF $0.50

Volume II describes the design and equipment installation for the field program. In preparation for static firing tests, an elaborate installation was completed on San Nicolas Island to provide measurements of particle size, fallout, surface contamination, dimensions and concentration of the rocket motor exhaust clouds. For the tracer studies of long-range diffusion, an airplane equipped with a drum-impactor sampler and recording temperature and flight instruments was used for measurements. Land-based radar was used for position determination. To assist in locating the tracer plume, constant level balloons (tetroons) were released with the tracer plume and tracked by radar. Author (TAB)

N66-25676# Geophysics Corp. of America, Bedford, Mass. GCA Technology Div.
ATMOSPHERIC TRANSPORT OF ROCKET MOTOR COMBUSTION BY-PRODUCTS. VOLUME I: DATA ANALYSIS AND PREDICTION TECHNIQUES Final Report
H. E. Cramer, H. L. Hamilton, Jr., and G. M. De Santo Dec. 1965 159 p refs
(Contract N123(61756)34567(PMR))
(AD-630205) CFSTI: HC $15.50/MF $1.00

The development of a diffusion model and techniques for predicting atmospheric contaminant concentrations and dosages at long distances downwind from a short-duration source on San Nicolas Island, California are described. This development was required to assist in the determination of the suitability of San Nicolas Island as a site for static testing of toxic fuel. The model is based on measurements made during a field program using a nontoxic tracer (zinc cadmium sulfide), on the results of earlier field programs, and on theoretical work. The subsidence inversion layer of the subtropical high pressure cell normally overlying this area and the disturbed wind flow regime in the lee of the island introduced unique features to this diffusion problem. Volume I contains the theoretical background, data analysis, and a description of the development of an operational model for diffusion prediction. The problem of cloud depletion through gravitational settling and other phenomena are discussed. Author (TAB)

N66-25678# California Univ., Los Angeles. Dept. of Engineering.
APPLICATION OF A RESTRUCTURABLE COMPUTER SYSTEM TO NUMERICAL WEATHER PREDICTION COMPUTATIONS
Gary Richard Wood Feb. 1966 161 p refs
(Contracts Nonr-233(52); AT(11-1)-GEN-10))
(Rept.-66-14; AD-630439) CFSTI: HC $15.70/MF $1.00

The restructurable computer system consists of a fixed computer (F) plus a variable structure (V) which work cooperatively toward the solution of a problem. The variable structure utilizes a variety of high speed computing modules which may be interconnected to form a highly parallel, problem-oriented special-purpose computer. The first step in the investigation was a detailed analysis of the numerical weather prediction program to determine the basic algorithms and the characteristics of the problem which might require special attention. The iterative nature of the program and the fact that calculations at each grid point are independent of each other and require access to data describing only a small neighborhood of grid points led to the development of a special memory buffer. This type of memory allows parallel access to 25 data words and provides a means of rapidly advancing calculations from one grid point to the next. A timing analysis of the proposed system was conducted utilizing a computer program called the 'Automatic Assignment Routine' which assumed the availability of from one to four IBM 7090 arithmetic units for use as computing modules in V. This analysis showed that the F+V system could be expected to produce a speed advantage of about three to one over a standard IBM 7094 system. Author (TAB)

N66-25747*# National Aeronautics and Space Administration, Washington, D. C.
INTERPRETATION OF RADIATION DATA FROM METEOROLOGICAL SATELLITES
K. Ya. Kondrat'yev *In its* Space Res. May 1966 p 741–757 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

This article examines the problem of interpreting radiation data from meteorological satellites to supplement the analysis of weather forming processes. One of the fundamental problems in long term weather forecasting is the necessity of accounting for energetics of large scale atmospheric processes. This problem is discussed in terms of satellite measurements of departing radiation and albedo in determining the terrestrial radiation budget. Also mentioned are several simple cases of satellite meteorology involving the determination

of various meteorological parameters; including cloud cover, cloud temperature and altitude, tropospheric humidity, and vertical cloud movements; from measurement data on departing radiation. R.N.A.

N66-25787# Defence Research Board, Ottawa (Ontario) Directorate of Scientific Information Services.
THE SQUEAK OF SNOW
V. A. Arabadzhi and K. I. Rudik Jan. 1966 6 p Transl. into ENGLISH from Priroda (Moscow), v. 10, 1963 p 106-107
(T-447-R) CFSTI: HC $1.00/MF $0.50

The acoustic spectrum of the squeak of snow at −1.5° and −15° C was obtained. The sound caused by walking on snow was recorded by means of a dynamic microphone having a passband of 500 cycles to 8 kilocycles per second, connected to a portable tape recorder. At −1.5° a marked maximum energy was found to occur at about 300 cycles. At the lower temperature, the spectrum was found to broaden quite noticeably into the region of higher frequencies. The two spectra are included. N.E.N.

N66-25842# Miami Univ., Coral Gables, Fla. Radar Meteorological Lab.
MESOSCALE STUDIES OF INSTABILITY PATTERNS AND WINDS IN THE TROPICS Semiannual Report No. 1, 1 Jun.-30 Nov. 1965
Harold P. Gerrish and Homer W. Hiser Feb. 1966 44 p refs
(Contract DA-28-043-AMC-00443(E))
(Rept.-10; AD-629952) CFSTI: HC $4.60/MF $0.50

Atmospheric refractive and temperature conditions associated with moist season tornado, waterspout, and hail systems in South Florida are surveyed using routine radiosonde soundings from Miami Airport. Rain camera data are used to provide cursory information on rainfall rates in easterly wave and air mass showers at the University of Miami. A general description of recent modifications made on radar equipment at the University is presented. Brief comments are made about two remarkable rainstorms that produced 24-hour rainfall amounts on the order of 20 inches or more in essentially the same portion of the Lower East Coast of Florida in October 1965. Author (TAB)

N66-25919# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
SIMULATION OF DRIFTING SNOW
Fuat Oder Oct. 1965 23 p refs
(CRREL-174; AD-630116) CFSTI: HC $2.60/MF $0.50

Scale factors which are based on geometric, kinematic and dynamic similarity requirements are derived in order to simulate drifting snow in a wind tunnel. The scale factors related to threshold characteristics involve unknown functions that should be determined if a proper simulation of drifting is desired. The scale factors derived from the equation of motion of the particles apply to the conditions where low frequency turbulence with large eddies occurs. Further research is necessary to extend knowledge of the motion of particles in a medium where high frequency turbulence with small eddies exists. Author (TAB)

N66-25949# Dayton Univ., Ohio. Research Inst.
DEVELOPMENT OF METHODS TO DETERMINE WINDS, DENSITY, PRESSURE, AND TEMPERATURE FROM THE ROBIN FALLING BALLOON Final Report, Nov. 1960-Apr. 1965
Nicholas A. Engler May 1965 158 p refs
(Contract AF 19(604)-7450)
(UDRI-TR-66-101; AFCRL-65-448; AD-630200) CFSTI: HC $5.00/MF $1.00

The 'March 1965 ROBIN Program' written to obtain meteorological parameters from radar tracking data only is presented. The errors in the resulting data are derived and analyzed. A least square technique, evaluated by data from dual radar tracked flights, is used to smooth the coordinate data and, hence, to determine the most likely velocity and acceleration. The resulting meteorological data is found to be accurate within ±6 knots for winds at the high (60 km) altitude and ±3 knots for winds at the low (35 km) altitude. For density and temperature, accuracy is within 6% and 10%, respectively, for the high altitude and 3% and 14%, respectively, for the low altitude. Meteorological parameters from several flights found by the use of the computer program are discussed. Author (TAB)

N66-25950# Air Weather Service, Washington, D. C.
ESTIMATING MEAN CLOUD AND CLIMATOLOGICAL PROBABILITY OF CLOUD-FREE LINE-OF-SIGHT
John T. Mc Cabe Nov. 1965 31 p refs
(AWS-TR-186; AD-630289) CFSTI: HC $2.00/MF $0.50

A method is described which provides an estimate of the probability of cloud-free line-of-sight between any two levels at any angle to the horizon for locations having standard surface-observed cloud data. The method uses the mean cloud amount between the surface and each higher kilometer level to estimate the mean cloud amount at any level, the mean cloud amount above any level and the mean cloud amount between any two levels. Analyses of sunshine and total cloud cover by time of day provide a basis for estimating probability of cloud-free line-of-sight through the whole atmosphere as a function of mean total cloud cover and viewing angle. This relationship is used to estimate the probability of cloud-free line-of-sight at any angle between any two levels for which the mean cloudiness between the levels is known or estimated. Height vs distance profiles of estimated probability of cloud-free line-of-sight can be prepared manually or by computer for any kilometer height reference levels. Author (TAB)

N66-25988# Weather Bureau, Las Vegas, Nev. Research Station.
WEATHER AND SURFACE RADIATION PREDICTION ACTIVITIES FOR THE SALMON EVENT—PROJECT DRIBBLE Final Report
14 Dec. 1965 41 p refs Sponsored by AEC
(VUF-1020) CFSTI: HC $2.00/MF $0.50

The Weather Bureau provided weather planning and prediction for the radiological safety program of the Salmon event, Project Dribble. Observations of winds and weather conditions at the site began 20 months prior to the event. Wind and temperature soundings and weather and radioactivity forecasting facilities were added during the detonation and post-event drilling phases. The winds during the 4 weeks following the Ready date were sufficiently abnormal in direction and speed that the planned firing criteria were not met, resulting in delays and changes in criteria to accept a wider range of conditions. Author (NSA)

N66-26176# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
STABILITY AND DIFFERENTIAL ADVECTION ASSOCIATED WITH TORNADO DEVELOPMENT

Tetsuya Fujita and Dorothy L. Bradbury Mar. 1966 24 p refs Ch. VI of a Comprehensive Study of the Palm Sunday Tornadoes, 1965
(Grant Cwb-WBG-41)
(SMRP-RP-52)

For the purpose of evaluating the usefulness of two parameters, the Best Lifted Index and the Material Differential Advection, the Palm Sunday tornado case was selected. Test analyses revealed that the Best Lifted Index is fairly conservative against the time of day since it automatically excludes high index values resulting from low-level cooling. The areas of specific Best Lifted Index can, therefore, be predicted by advecting them for hours if the movements of other meteorological systems are also known. By expanding conventional Differential Advection, which refers to a fixed location on the earth, a generalized differential advection above the air column moving with either high- or low-level winds has been proposed. This advection, called the Material Differential Advection, gives the rate of change in the lapse rate above horizontally advected air which will rise violently upon reaching the region of steep temperature lapse rate. The Material Differential Advection, when computed while moving with high-level winds, indicates the possibility of initiating strong upward motion in the underlying layers. Author

N66-26182# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
MODEL OF TYPHOONS ACCOMPANIED BY INNER AND OUTER RAINBANDS
Tetsuya Fujita, Tatsuo Izawa, Kazuo Watanabe, and Ichiro Imai (Meteorol. Res. Inst.) Mar. 1966 35 p refs
(Grants Cwb-WBG-34; Cwb-WBG-70; NSF GF-179)
(SMRP-RP-60)

Both hurricanes and typhoons are relatively circular storms with their winds at high levels blowing mostly outward. Assuming that the outflow is characterized by central motion under the influence of the pressure-gradient forces pointing toward the storm center, the absolute angular momentum of the outflow winds and radar echoes were computed. The upward motion inside these echoes plays an important role in the upward transport of the low-level angular momentum. Detailed analysis made by using satellite, radar, and aerological data revealed that the absolute angular momentum of radar echoes near the eye wall is almost one order of magnitude smaller than that of the echoes in the outer rainbands. This fact leads to a suspicion that the radial distribution of the vertical velocity inside a storm would significantly alter the pattern of the outflow winds near the storm top. A numerical model, including the radial distribution of the vertical velocity, was thus established. Computations indicated that the vertical transport of momentum by outer rainbands alters the outflow wind pattern, resulting in the formation of a ring of high-cloud-free region which separates the inner cirrus shield from the outer cirrus decks. This ring sometimes appears as a clear area on a satellite photograph. Author

N66-26292# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
SOUTHEAST ASIA MONSOON STUDY Second Technical Report, 1 Sep.-31 Dec. 1965
Herbert Riehl Feb. 1966 38 p refs
(Contract DA-28-043-AMC-01303(E))
(Rept.-2; AD-631085) CFSTI: HC $2.00/MF $0.50

The objective of this program has been to investigate the following aspects of this seasonal reversal: (1) Definition of the onset of the summer monsoon over Southeast Asia and statistical analysis of onsets; (2) Role of the tropical cyclone during the onset; (3) Seasonal changes of upper-air currents over Asia and the differences which may exist between late and early onset years; (4) Influence of seasonal heating and changes in thermodynamic structure of the atmosphere over southern Asia during onsets; (5) Retardation of the monsoon over India as compared with Southeast Asia. Generally, three types of synoptic disturbances can be found over Southeast Asia. The warm core case has been described in this series of technical reports (1); the cold core case will be studied next. The third case, the equatorial shearline (equatorial convergence zone) is the object of this study. Its purpose is to determine the average field of motion and the distribution of precipitation on a cross-section normal to the shearline. Author (TAB)

N66-26328# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
MEASUREMENT OF DROP SIZE DISTRIBUTIONS IN NATURAL CLOUDS AND RAIN Final Report, Apr. 1964-Mar. 1965
Delbar P. Kelly 31 Mar. 1965 25 p refs
(Contract AF 19(628)-4085)
(AFCRL-65-921; AD-630706) CFSTI: HC $2.00/MF $0.50

Some fog drop size distributions taken during Operation Catfeet are presented. Calibration droplets with a range of positive and negative charges may be generated by control of the bulk water supply voltage, without affecting the response of the electrostatic probe used to size and count them. Author (TAB)

N66-26360# Electronic Systems Div., Bedford, Mass. Decision Sciences Lab.
A STUDY IN INFORMATION PROCESSING: ELECTROLUMINESCENT VS TELETYPE READABILITY OF WEATHER MESSAGES
Alan M. Kershner and Donald L. Avery Dec. 1965 75 p refs
(FSD-TR-66-149; AD-630636) CFSTI: HC $3.00/MF $0.75

An investigation was undertaken to provide a human factors evaluation of an electroluminescent display designed for the presentation of around-the-base weather messages. Time and error data were obtained for 42 Air Force weather, GCA, and pilot personnel in responding to six questions for each of 50 weather messages, 25 of which were presented on an electroluminescent display and 25 by conventional teletype format. The few significant differences found do not warrant a conclusion that the electroluminescent format employed is inferior to the conventional teletype format. It is concluded that weather message information processing may be improved by the development of time and error normative data for a standard set of weather messages, thereby permitting the identification of high-error personnel, by training to improve the interpretation of visibility coding and more specifically, by an improved formating of fractions concerned with visibility. This study may be of assistance to the display designer and for the training of military and civilian personnel in weather message interpretation. It has value for the improvement of weather message formating as well as highlighting the importance of appropriate personnel selection and training for tasks involving the processing of information in complex displays. Author

N66-26418# Emmanuel Coll., Boston, Mass. Research Language Center.
THE EFFECTS OF THERMAL STRATIFICATION ON THE TURBULENT EXCHANGE IN A DIABATIC SURFACE LAYER

Su Tsung-Shian Bedford, Mass., AFCRL, Nov. 1965 30 p refs Transl. into ENGLISH from Acta Met. Sinica. (Peking), v. 33, no. 4, 1963 p 435–448
(Contract AF 19(628)-5073)
(EMM-65-42; AD-631058) CFSTI: HC $2.00/MF $0.50

This paper studies the effects of stratification on the turbulent exchange in the surface layer of the atmosphere using the similarity theory and dimensional analysis. Using recently published data, the magnitudes of the empirical coefficient D in the general function of turbulent exchange are calculated. A scheme of transition from forced to free convection showing a rather smooth character is developed. Based on the characteristic length L_{Rf} the author sets up a turbulent exchange model for a diabatic surface layer. Author (TAB)

N66-26438# Air Force Cambridge Research Labs., Bedford, Mass.
THE CUMULUS AND METEOROLOGICAL EVENTS OF THE FLORIDA PENINSULA DURING A PARTICULAR SUMMERTIME PERIOD. CLOUD REFRACTIVE INDEX STUDIES IIIA Interim Scientific Report
Vernon G. Plank Oct. 1965 203 p refs *Its* Environmental Res. Paper No. 151
(AFCRL-65-761; AD-629933) CFSTI: HC $20.20/MF $1.25

The cumulus cloud events of the Florida peninsula that were observed during a 19-day period of photoreconnaissance in August and September 1957 are described and illustrated. The associated meteorological and rainfall events are also described and the intercorrelations among the various observations are pointed out. The study findings revealed that the principal factors governing the cloud and rainfall situations of the different days were (1) the low-level advection of water vapor into the peninsula from the oceanic surroundings, (2) the wind transport, into the heated peninsula from the oceans during the daytime, of pre-existing cumulus populations containing appreciable liquid water, (3) the low-level convergence, and associated updraft motion, engendered by the synoptic situation and the peninsula sea breezes, and (4) the precipitable water content of the lower Florida air mass. Author (TAB)

N66-26571# IIT Research Inst., Chicago, Ill.
EXPERIMENTAL FEASIBILITY STUDY OF REMOTE MICROWAVE MEASUREMENT OF ATMOSPHERIC TEMPERATURE Final Report, 1 Apr. 1964–31 Dec. 1965
David Fryberger 31 Dec. 1965 319 p refs
(Contract AF 19(628)-4022)
(AFCRL-66-93; AD-630460) CFSTI: HC $7.00/MF $1.50

This report discusses the problem of deducing a profile of atmospheric temperature versus height from an empirically measured profile of integrated radiometer temperature versus elevation angle. The basic radiometer equation is derived and several mathematical techniques for inverting it are discussed. The sources of errors are enumerated, and a quantitative analysis of the propagation of these errors through this inversion process has been done. The relative magnitude of the resultant errors is given. These results indicate that there are very serious error problems associated with this technique for the measurement of atmospheric temperature. These difficulties indicated by the results of the theoretical study were substantiated by the inversion of four sets of actual radiometric temperature data. Author (TAB)

N66-26601# Woods Hole Oceanographic Institution, Mass.
METEOROLOGICAL STUDIES
Claude Ronne Feb. 1966 11 p refs
(Contract Nonr-4071(00))
(WHOI-66-5; AD-630110) CFSTI: HC $1.60/MF $0.50

Weather modification Studies as Recorded Photographically. During April and August 1963 the Barbados Weather Modification Project made extensive use of whole-sky, time-lapse and conventional photography to investigate cloud and rain formation over tropical heat sources. These observations were made from land-based, ship-borne and aircraft stations. In July 1965 further photographic studies were carried out over the eastern Caribbean Sea to evaluate the effect of seeding cumulus clouds with silver iodide bombs. Author (TAB)

N66-26615# Emmanuel Coll., Boston, Mass. Research Language Center.
AN ANALYSIS OF THE VARIOUS FACTORS IN RAIN FORMATION WITH RESPECT TO FLUCTUATIONS OF THE VERTICAL CIRCULATION
Hua-Ying Hsu Bedford, Mass., AFCRL [1965] 12 p refs Transl. into ENGLISH from Ch'i Hsiang hsueh Pao (Peking), v. 34, no. 3, 1964 p 378–382
(Contract AF 19(628)-5073)
(EMM-65-26; TT-66-61020; AD-631116) CFSTI: HC $1.00/MF $0.50

It was pointed out in a previous work that fluctuations of the ascending air current play an important role in the formation of precipitation elements in a shallow warm cloud. Based on this concept this paper further analyzes the effects of the various factors involved. It is shown that precipitation can develop only when there is an optimum combination of such parameters as the fluctuation of the vertical velocity, the average vertical velocity, the moisture content in the cloud and the cloud thickness. The paper discusses particularly the effect of the fluctuation on the raindrop spectrum. It appears that if the fluctuation is too great it will not benefit rain formation. TAB

N66-26674# Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
U.S. ARMY PARTICIPATION IN THE METEOROLOGICAL ROCKET NETWORK
Jan. 1966 22 p
(ECOM-5028; AD-630813)

This report documents the requirements, responsibilities, and activities of the U. S. Army in the initiation, development, and operation of the meteorological Rocket Network. Author

N66-26680# Emmanuel Coll., Boston, Mass. Research Language Center.
TURBULENCE IN THE SURFACE LAYER OF A STRATIFIED ATMOSPHERE
Tsung-Shian Su Bedford, Mass., AFCRL, Nov. 1965 21 p refs Transl. into ENGLISH from Acta Met. Sinica (Peking), v. 29, no. 2, 1958 p 73–82
(Contract AF 19(628)-5073)
(EMM-65-41; AD-631060) CFSTI: HC $1.00/MF $0.50

This paper discusses turbulent exchange in the surface layer of a stratified atmosphere. First, considering the effect of thermal stratification on turbulence, a new form of function of the Richardson number is derived from the energy balance equation of a turbulent atmosphere. Secondly, a reasonable function is proposed describing the vertical distribution of elements in the stratified atmospheric surface layer. Several graphs are also given which make an accurate calculation of the turbulent characteristic values possible, such as turbulent exchange based on the observed data. Some computations based on observed data are furnished for comparison with others. It is shown that the treatment in

this paper is reasonable and the results are better than those of Monin and Obukhov. Author (TAB)

N66-26681# Emmanuel Coll., Boston, Mass. Oriental Science Library.
TURBULENT DIFFUSION FROM A CONTINUOUS POINT SOURCE IN THE PRESENCE OF VERTICAL ADVECTION
Hsui-Ch'ing Lo Bedford, Mass., AFCRL, Nov. 1965 15 p refs Transl. into ENGLISH from Acta Met. Sinica (Peking), v. 33, no. 3, 1963 p 375–381
(Contract AF 19(628)-5073)
(EMM-65-17; AD-631059) CFSTI: HC $1.00/MF $0.50

This paper discusses the problem of diffusion from an unsteady continuous point source in a turbulent atmosphere. The influence of vertical current, the deposition of the diffusing particles and the 'Net-catching Effect' (absorption by ground surface) are considered. The theoretical formulas for the evaluation of the concentration field are derived. Several sample computations are presented and it is shown that there is good agreement between the computed results and observed data. Author (TAB)

N66-26685# Emmanuel Coll., Boston, Mass. Oriental Science Library.
A DYNAMIC ANALYSIS OF THE DEVELOPMENT OF CUMULONIMBUS INCUS
Shing-Sheng Li, Jih-Ping Chao, and Yiin-Chyau Hwu Bedford, Mass., AFCRL, Feb. 1966 20 p refs Transl. into ENGLISH from Acta Met. Sinica (Peking), v. 34, no. 2, 1964 p 225–232
(Contract AF 19(628)-5073)
(EMM-65-36; AD-631118) CFSTI: HC $1.00/MF $0.50

This paper analyzes the development of the cumulonimbus incus using an approximate solution of the nonlinear differential equations of cumulus dynamics in which the latent heat of condensation is considered. It is shown that the incus structure is a necessary consequence of a strong cumulus development. Author (TAB)

N66-26768# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON METEOROLOGY AND CLIMATOLOGY [LITERATUUROVERZICHT METEOROLOGIE KLIMATOLOGIE]
16 Apr. 1966 25 p refs In DUTCH, ENGLISH, and GERMAN Vol. 12, No. M-137
CFSTI: HC $1.00/MF $0.50

Abstracts and bibliographic notes are presented on the topics of detection methods and instruments, satellite meteorology, numerical prediction techniques, the mechanics and thermodynamics of air circulation, weather disturbances, temperature, horizontal and vertical air currents, condensation and precipitation, and weather control. Transl. by J.O.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N66-25465# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Institut für Flugfuhrung.
MATHEMATICAL FUNDAMENTALS FOR THE REPRESENTATION OF THE OPTICAL ENVIRONMENT FOR AIRCRAFT AND SPACECRAFT [MATHEMATISCHE GRUNDLAGEN ZUR DARSTELLUNG DER OPTISCHEN UMWELT FUR LUFT- UND RAUMFAHRZEUGE]
R. Beyer Dec. 1965 25 p In GERMAN, ENGLISH summary
(DLR-MITT.-65-16) CFSTI: HC $1.00/MF $0.50

For the guiding of aircraft and spacecraft, realistic representations of the optical environment are required. Using transformation equations for geodesic and body-fixed coordinate systems, the projection of the optical environment of a missile on a body-fixed projection plane is calculated in a general form for a stereoscope representation. Author

N66-25547*# Stanford Research Inst., Menlo Park, Calif.
INFORMATION REQUIREMENTS FOR GUIDANCE AND CONTROL SYSTEMS
John Peschon, Lewis Meier, III, Robert E. Larson, Wade H. Foy, Jr., and Charles H. Dawson Washington, NASA, May 1966 188 p refs
(Contract NAS2-2457)
(NASA-CR-453) CFSTI: HC $5.00/MF $1.25 CSCL 17G

The dependence of the performance of a control or guidance system upon the information-handling characteristics of its key constituents, notably the measurement and control subsystems, is discussed. To determine this dependence, the disciplines of control theory and information theory are reviewed and extended. The notions of quantity of information and value of information are shown to be the principal measures of information; however, entropy (the measure of quantity) is of very limited assistance for the design of control and guidance systems. The dependence of system performance on the information-handling characteristics of its constituents is investigated for optimum controllers and fixed controllers. Additional results relating to the optimum design of quantized control systems, information systems, and adaptive systems are given. Author

N66-26262*# New York Univ., N. Y. Lab. for Electroscience Research.
A TOPOLOGICAL APPROACH TO THE PROBLEM OF SEARCHING ON A CONTOUR MAP
Stephen P. Morse Jan. 1966 41 p refs *Its* Tech. Rept.-400-129
(Grant NGR-33-016-038)
(NASA-CR-74970) CFSTI: HC $2.00/MF $0.50 CSCL 17G

This report is concerned with the problem of obtaining the ground track of an aircraft, given the elevation below each point of the aircraft during flight and a contour map of the terrain. Problems of this type cannot be solved in a direct manner. Exhaustive searches are impractical. What is needed are efficient search strategies that can yield a solution in a reasonable time. Searches can be facilitated by taking advantage of the topological properties of the map. This is done by using a sequence of numbers that coveys information about the contour lines intersected, the contour lines traveled along, and the intercontour regions passed through by the ground track. The sequence can be deduced from the known ground profile. An examination of the map topology presented in graphical form will indicate which areas of the map can contain the ground track and which areas cannot, thereby severely narrowing down the search possibilities. Author

N66-26272*# IIT Research Inst., Chicago, Ill.
ANALYSIS OF AN OPTIMAL CELESTIAL-INERTIAL NAVIGATION CONCEPT FOR LOW-THRUST INTERPLANETARY VEHICLES
Alan L. Friedlander Washington, NASA, May 1966 142 p refs
(Contract NAS2-2401)
(NASA-CR-457) CFSTI: HC $4.00/MF $1.00 CSCL 17G

This report describes the results of a celestial-inertial navigation study applied to thrusted interplanetary vehicles powered by an electric propulsion system. The background of the low thrust propulsion, trajectory, and mission characteristics, and of the navigation problem are briefly discussed. The mathematical formulation and analysis of the celestial-inertial navigation concept are presented. A description of the inertial and celestial measurement processes and the assumed statistical characteristics of the instrumentation errors is presented along with a brief analysis of gyro drift compensation provided by star fixes and appropriate correction of inertial platform misalignment. The linearized trajectory model and the state estimation equations are also given. The digital computer simulation program developed to evaluate the performance of the navigation procedure is described. Numerical results obtained from the computer program are discussed. R.N.A.

N66-26892# Naval Ordnance Lab., Corona, Calif. Missile Systems Dept.
INVESTIGATIONS OF THE DESIGN OF ADAPTIVE AUTOPILOT SYSTEMS
Patrick C. Palmore and Donald R. Totten 4 Jan. 1966 160 p refs
(NAVWEPS-8834; AD-626763) CFSTI: HC $5.00/MF $1.00

Basic adaptive control philosophies and techniques are discussed. Numerous parametric performance relationships are provided for both linear and nonlinear attitude and translational acceleration control systems. A number of primary problems are defined and a few applicable control techniques are examined. Author (TAB)

N66-26699*# Auburn Univ., Ala. Advanced Studies Group.
AN INTRODUCTION TO ANALYTIC PLATFORMS FOR INERTIAL GUIDANCE
J. L. Lowry Apr. 1966 99 p refs
(Contract NAS8-20004)
(NASA-CR-75074) CFSTI: HC $3.00/MF $0.75 CSCL 17G

The concept of the analytic platform inertial navigation system is reviewed and a summary of the construction and operation of an ideal single axis reference (SAR) and an ideal pendulous integrating gyro accelerometer (PIGA) is made. Four different methods are presented that relate the vehicle coordinates to those of the inertial reference, and the mathematics that enable one to calculate these transformations from the angular rates of the vehicle are presented. Matrix operations and numerical integration techniques are presented as an aid in the calculation of the rotational transformations. The orthogonality and normality conditions are presented, as is the definition of the orientation of the space-fixed and vehicle-fixed coordinate systems. Author

N66-26825*# Auburn Univ., Ala. Advanced Studies Group.
ANALYTIC PLATFORM SIMULATION
J. L. Lowry Apr. 1966 105 p ref
(Contract NAS8-20004)
(NASA-CR-75254) CFSTI: HC $4.00/MF $0.75 CSCL 17G

This technical report is a documentation of the analytic platform simulation program written in Fortran IV computer language and following a modular form. Chapter I states the need for such a simulation program. Chapter II states the capabilities of the program, presents the definitions of the various quantities used in the computer program, and lists the equations solved in the various subroutines. A complete program listing is presented in Chapter III along with the analytic platform simulation flow chart. Chapters IV and V present a typical test case and explain the operating procedures for the use of the simulation program. Author

N66-26881*# Massachusetts Inst. of Tech., Cambridge. Experimental Astronomy Lab.
A STATISTICAL ANALYSIS OF GYRO DRIFT TEST DATA, VOLUME I
John Richard Cooper (M.S. Thesis) Sep. 1965 108 p refs
(Grant NGR-22-009-078)
(NASA-CR-75226; TE-13) CFSTI: HC $4.00/MF $0.75 CSCL 17G

The drift rate data derived from a manufacturer's testing of 50 inertial grade gyroscopes, is analysed to derive a statistical model for use as a predictor. The initial hypothesis of a simple random walk is shown to be a reasonable approximation to the actual data, and an explanation of the discrepancies suggests a more complex model, but basically of the same type. The simpler model is then used to generate synthetic gyro drift rate data as an input to a computer simulation of an inertial navigator, and the resulting system output errors are derived. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N66-25400# United Kingdom Atomic Energy Authority, Risley (England). The Reactor Group.
THE OXIDATION OF SUPERHEAT MATERIALS IN STEAM: AUSTENITIC STAINLESS STEELS
J. Board, G. Holyfield, and J. Dalley 1966 30 p refs Presented at the Intern. Study Days on Oxidation of Metals, Brussels, 6-8 Oct. 1965
(TRG-1148(C/X))

The corrosion in steam of a wide range of potential alloys for use as fuel element cladding in the superheat elements of the Steam Generating Heavy Water Moderated Reactor have been studied, including austenitic stainless steels, ferritic stainless steels, and high-nickel alloys. The tests were carried out in atmospheric-pressure steam at 550, 650, and 750°C and also in high-pressure steam at 650 and 750°C. In this report results for the austenitic stainless steels are given, including weight gain data to 12000 hours, detailed metallography, and microprobe analysis. The results show that 20/25/Nb stainless steel is superior to the 18/8 series of stainless steels and would have satisfactory corrosion resistance to steam up to 750°C. The corrosion resistance of the stainless steels is shown to depend largely on the fabrication history of the steels, and the importance of cold-worked surface

layers, grain size, and chromium volatilization from the surfaces during high-temperature anneals is demonstrated.
Author

N66-25402# Atomic Energy Establishment, Winfrith (England). General Reactor Physics Div.
ARGOSY 4: A PROGRAMME FOR LATTICE CALCULATIONS
J. D. Macdougall Jul. 1965 92 p refs
(AEEW-R-445) HMSO: 11s

Input requirements, calculations methods, and printed results are presented for the Argosy 4 computer program. Calculations for lattice and burnup, control rod, and reflector are described; and data requirements, equations used, and output of the program are included. Lattice calculation details the cell geometry and formulation of the smeared cell; thermal, resonance, and fast group calculations; streaming, the criticality equation and group condensation; and leakage problems. Differences between the present program and earlier Argosy versions are considered.
M.W.R.

N66-25417# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
ON THE BINDING OF INERT GAS BUBBLES TO PRECIPITATES
R. S. Nelson Dec. 1965 19 p refs
(AERE-R-5060)

The equilibrium configuration of inert gas bubbles attached to precipitates has been discussed. It is shown that the energy gained on attachment in enveloping the interface is exactly equal and opposite to that necessary to create the new equilibrium surface area. The binding energy between the two therefore depends only on the work done by the gas on expansion to its new equilibrium volume. The retaining force of precipitates is compared with various bubble driving forces expected to occur in nuclear fuels in an attempt to evaluate the effectiveness of precipitates in controlling swelling and gas release by restricting the motion of bubbles. It is concluded that the precipitate must have a high interfacial tension in order to give adequate control at high burn up.
Author

N66-25433# United Kingdom Atomic Energy Authority, Harwell (England). Health Physics and Medical Div.
THE COUNTING, SIZING AND SAMPLING OF AITKEN NUCLEI IN GAS COOLED REACTORS
W. J. Megan and R. D. Wiffen Jan. 1966 30 p refs
(AERE-R-5120)

Methods of counting and sizing Aitken nuclei are described and their application to pressurized gas cooled reactors discussed. It is concluded that the most satisfactory instrument at present available for determining concentrations of Aitken nuclei in reactors is the Nolan Pollak counter. A method is given of estimating the percentage release of gas borne particulate fission products through a specified leak by measuring the rate of disappearance of particles by deposition in the reactor. A description is given of a simple pressurized sampling arrangement for obtaining samples of particles from ractors in a form suitable for electron microscopy. The use of the Nolan Pollak counter is further considered as a means of conducting "in place" tests of high efficiency filter installations and it is concluded that the counter will be of considerable value in this application.
Author

N66-25459# United Kingdom Atomic Energy Authority, Dounreay (Scotland). Experimental Reactor Establishment.
THE SAFE TRANSPORT OF RADIOACTIVE MATERIALS. A KEY TO THE 1964 REVISION OF THE INTERNATIONAL ATOMIC ENERGY AGENCY'S REGULATIONS
A. E. Shaw 1965 32 p
(TRG-1073(D)) HMSO: 3s 6d

This document presents a key to the revised International Atomic Energy Agency's regulations for the safe transport of radioactive materials. The key is similar to those used by biologists for the precise identification of species of plants and animals. By knowing what radioactive material has to be transported in terms of element, isotope, and total and specific activities; the material's chemical and physical form; and details of the package type; a step by step use of the key will indicate the correct operational procedure. The appendices include information on external radiation dose rate and surface contamination level limits for packages in which radioactive materials are stowed, stores, or transported; labelling, marking, approval, and documentation procedures; special form radioactive material; and full load conditions.
R.N.A.

N66-25480# Westinghouse Electric Corp., Pittsburgh, Pa.
SAXTON PLUTONIUM PROGRAM Quarterly Progress Report, Period Ending 30 Sep. 1964
N. R. Nelson Brussels, EURATOM, Feb. 1966 68 p refs
(Contract AT(30-1)-3385)
(EUR-2678.e, Pt. 1; EURAEC-1256) CFSTI: HC $3.00/MF $0.75

Preliminary work has started on the Saxton Plutonium project, the purpose of which is to develop information concerning the utilization of plutonium enriched fuel in pwr systems, through design, fabrication and operation of a partial core of PuO_2–UO_2 fuel in the Saxton reactor. To meet these objectives, in-pile performance of this fuel will be evaluated and post-irradiation examination of fuel samples will be made. Performance will be analyzed and compared with analytical predictions. Prior to loading, critical experiments will be conducted to evaluate nuclear design methods and to predict reactivity and power distribution of the PuO_2–UO_2 fuel rods in the Saxton core. Prior to startup, a series of zero and low power physics measurements will be made to verify reactivity, control rod and boron worth, flux and power distribution, and temperature, pressure and power coefficients. These characteristics, as well as core thermal and hydraulic performance, will also be measured at intermediate and full power levels. Similar data will be obtained during a minimum of four reactor shutdowns to determine characteristic changes with irradiation.
Author

N66-25499# Aktiebolaget Atomenergi, Stockholm (Sweden).
CROSS SECTION MEASUREMENTS FOR SOME ELEMENTS SUITED AS THERMAL SPECTRUM INDICATORS: Cd Sm Gd AND Lu
Evelyn Sokolowski, Helmut Pekarek, and Erik Jonsson May 1964 28 p refs
(AE-143) CFSTI: HC $2.00/MF $0.50

The effective cross sections of Cd, Sm, Gd and Lu have been measured by the oscillator technique in the spectrum of the central channel of reactor R1. For Cd, Sm and Gd the 2200 m/s cross sections were deduced on the basis of Westcott's g and s factors. The values obtained were generally in agreement with other recent values obtained by integral methods. For natural Lu, the energy dependence of the cross section is not well known. Certain assumptions about the cross section function led to unreasonably high values for the

2200 m/s cross section. Complementary differential measurements of the cross sections of Cd, Sm and Gd were made with the R1 fast chopper. For Cd and Sm the 2200 m/s cross section thus obtained agreed within experimental error with those obtained from the integral measurements. For Gd, the chopper measured value was higher, confirming earlier findings and indicating that the Westcott g factor for Gd is too high. Author

N66-25573*# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
TUNGSTEN NUCLEAR ROCKET, PHASE I, PART I Final Report
R. G. Bardes, S. C. Cohen, S. J. Friesenhahn, E. M. Gillette, E. Haddad et al 22 Apr. 1966 406 p refs
(Contract SNPC-27)
(NASA-CR-54909; GA-6890) CFSTI: HC $7.06/MF $2.00 CSCL 21F

Descriptions of the critical facility and the critical assemblies are given. Experimental measurements are presented and compared with analytical results. Three different core configurations of 121 fuel elements were assembled; two different pitches and both water and beryllium reflectors were used. Excess reactivity was held down by a cadmium nitrate solution. Results include the excess reactivity available in the cores, the worth of poison tubes and fuel element components at various locations, the temperature coefficient of the cores, flux and power distributions in a cell and throughout the core, neutron and gamma ray dose rate distributions throughout the core, pulsed neutron measurements, and reactivity comparisons using a special fuel section of enriched tungsten. Nuclear analysis of the assemblies required careful treatment of the extreme heterogeneities of the core. A detailed analysis which accounts for the two-dimensional cell structure, resonance overlap, and two-region resonance effects gave good agreement between calculations and the experimental results. Author

N66-25628# India. Dept. of Atomic Energy, Bombay.
CIR LOOP: A PROGRAM TO CALCULATE THE REACTIVITY LOAD AND RELATIVE POWER OUTPUT OF A LOOP IN CIR
K. R. Srinivasan and P. V. Suryanarayanan 1965 38 p refs
(AEET-237) CFSTI: HC $2.00/MF $0.50

This report gives the details of the program CIRLOOP which has been written in Fortran language for CDC-3600. The program calculates the reactivity load and power output of a loop in CIR at the central position. The program is mainly based on the method given by McKay and Smith. Author

N66-25649# United Kingdom Atomic Energy Authority, Risley (England).
THE USE OF DOUNREAY FAST REACTOR AS A MATERIALS TESTING REACTOR
I. R. Birss and T. P. Bishop 1966 29 p ref
(TRG-1039(D)) HMSO: 3s

This report is an introduction to the Dounreay Fast Reactor as a Materials Testing Reactor. It describes the facilities which are available for irradiation experiments; the environment which an experiment will experience; and the methods used to calculate doses, heat ratings, and burn-ups. These methods are to some extent dictated by the method of presentation of neutron data. Author

N66-25813# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.
ECONOMIC POWER FROM GAS-COOLED REACTORS
T. N. Marsham and J. D. Thorn 1966 17 p refs Submitted for Publication
(TRG-1139(R))

The 1200 mW nuclear power station to be built at Dungeness will produce electricity more than 10% cheaper than any coal or oil fueled station commissioning in the U.K. at the same time. It will have two advanced gas cooled reactors (AGR), incorporating a graphite moderator and carbon dioxide coolant, on-load fuel changing, integral prestressed concrete pressure vessels, and a new type of fuel, viz. stainless steel clad, slightly enriched uranium oxide pellets. This fuel allows higher operating temperatures and greater heat output per unit volume of core and pressure vessel than metallic uranium previously used in carbon dioxide cooled reactors. The development work and design studies which led to this commercial reactor system are described, and economic prospects for future AGR systems are indicated. Author

N66-25821# European Atomic Energy Community, Brussels, (Belgium).
A MEASUREMENT OF THE HYPERFINE STRUCTURE OF THE THERMAL FLUX DISTRIBUTION IN THE UC CLUSTERED FUEL ELEMENT ESSOR C-2-ϕ
S. Guardini and G. F. Pipitone 1966 48 p refs
(EUR-2714.e) CFSTI: HC $2.00/MF $0.50

The detailed hyperfine structure distribution of the thermal flux in the clustered fuel element of the first charge of the reactor has been measured by activation of Dy detectors. This element consists of a cluster of 4 uranium carbide rods, organic cooled, which is moderated by D_2O. Several degrees of poisoning of the element (corresponding to the increasing burn-up) have been investigated. The measured flux distributions have been compared with the corresponding distributions obtained by an analytical expression of empirical nature. Author

N66-25828# RAND Corp., Santa Monica, Calif.
NUCLEAR EXPLOSIONS IN CAVITIES
H. L. Brode Nov. 1965 69 p refs
(Contract AF 33(657)-9619)
(RM-3727; AD-623820) CFSTI: HC $3.00/MF $0.75

Underground cavities have been suggested as an effective means of reducing the seismic signals from nuclear detonations. This memorandum reports the wall pressures, temperatures, and densities for five specific examples, for which average cavity pressures range between 44 and 420 bars, with peak pressures between 0.2 and 8.2 Kbars. One nuclear yield, 1.7 kilotons, was exploded (theoretically) in two cavities of 20 and 40 meters radius, each with normal and one-tenth normal air density in it. The larger cavity was also used with a density of one-hundredth normal. In addition to the wall pressures, temperatures, and densities as functions of time for each case, some typical pressure, temperature, and density profiles in the cavity interiors at various times are reported. Author (TAB)

N66-25846# Naval Research Lab., Washington, D. C.
RADIATION DAMAGE SURVEILLANCE OF POWER REACTOR PRESSURE VESSELS
C. Z. Serpan, Jr., L. E. Steele, and J. R. Hawthorne 31 Jan. 1966 23 p refs
(NRL-6349; AD-629881) CFSTI: HC $1.00/MF $0.50

The deleterious effect of high energy neutrons upon the mechanical properties of reactor pressure vessel steels has prompted the employment of material surveillance programs in many nuclear power plants. These programs provide for

the exposure of test specimens representative of the reactor pressure vessel at in-reactor locations, wherein they will experience the same thermal and radiation damage history as the vessel itself. Evaluation of these specimens, which reveals the progressive changes in the mechanical properties of the vessel, provides a basis upon which operational procedures and maximum lifetime exposure may be formulated for the plant. A review and an analysis of several instances of shortcomings in surveillance programs are presented along with a set of recommendations for consideration in planning new surveillance programs. In utilizing these recommendations, pressure vessel surveillance programs can be made to provide valuable information for use in determining plant operations; at the same time results from these programs may add to the general knowledge of radiation effects in pressure vessel steels or other materials subject to radiation. Recognition of the value of surveillance programs and their conscientious application should further the public acceptance of nuclear reactors as safe alternative power systems. TAB

N66-25876# Battelle Memorial Inst., Columbus, Ohio.
FISSION-PRODUCT REACTIONS WITH AND RELEASE FROM FUEL-ELEMENT CLADDINGS Quarterly Progress Report, Jul.-Sep. 1965
Duane N. Sunderman, David L. Morrison, James E. Howes, Jr., and Edward J. Jablonowski 1 Oct. 1965 8 p
(Contract W-7405-ENG-92)
(BMI-X-10143) CFSTI: HC $1.00/MF $0.50

Experiments were undertaken to determine the effects of fission product concentration on diffusion in specimens of high-purity Fe-20 wt % Cr, on Fe-29 wt % Ni-13 wt % Cr specimens and on Fe-19 wt % Ni specimens. Experiments were also conducted to determine the fission-product diffusion rate in high-purity alloys during high-temperature irradiation. Data are included on irradiation conditions. Results of calculations of diffusion coefficients for Fe-Ni, Fe-Ni-Cr, and Fe-20 wt % are included. NSA

N66-25979# Aerojet-General Nucleonics, San Ramon, Calif. Oceanic Products Div.
MILITARY VEHICLES—MISSION ANALYSIS USING RADIO ISOTOPE SUBMERSIBLE ENGINES
Earl Finkle Mar. 1965 50 p refs
(Contract AT(04-3)-368)
(AGN-8138) CFSTI: HC $2.00/MF $0.50

A mission analysis was undertaken for a variety of underwater platforms and vehicles in order to determine the most promising applications of radioisotope propulsion systems. NSA

N66-25986# TRW Systems, Redondo Beach, Calif.
AN EXPERIMENTAL INVESTIGATION OF THE BEHAVIOR OF BERYLLIUM METAL IN SIMULATED LAUNCH PAD ABORT ENVIRONMENTS Final Report, Sep. 1963-Jul. 1965
J. L. Blumenthal and M. J. Santy Jul. 1965 224 p refs Prepared for Sandia Corp., Albuquerque, N. Mex.
(Contract AT(29-1)-789)
(SC-DC-65-1837) CFSTI: HC $6.00/MF $1.25

Comprehensive laboratory investigation of the chemical behavior of beryllium metal in a wide range of simulated launch abort environments was completed. A two phase laboratory program was conducted. The first phase of the program aimed at determining, as a function of temperature and pressure, with each of the major combustion gas species, the rate at which bulk beryllium metal was converted into combustion products (oxides, nitrides, etc.) and whether or not the reaction products formed were in a particle size range which could become airborne. The kinetics of the reactions of beryllium with the combustion gases oxygen, nitrogen, air, nitric oxide, carbon monoxide, carbon dioxide, hydrogen, and water vapor were investigated in the temperature range from 800 to 1500°C and over the pressure range from 0.1 mm Hg to atmospheric pressure. The second phase of the laboratory program involved semiquantitative observations of the behavior of beryllium in selected flame environments which were fully determined thermochemically. It was found that the degree of interaction between the flame environment and the beryllium components and the amount of airborne contamination which is released will increase rapidly with increasing beryllium metal temperature, concentration in the flame environment of water vapor and/or oxygen, and the total pressure of the environment. Other results are discussed extensively. NSA

N66-25994# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information Extension.
REACTOR SAFETY—A LITERATURE SEARCH
Richard J. Smith comp. Aug. 1965 67 p refs
(TID-3525(Rev. 5, Suppl. 2)) CFSTI: HC $3.00/MF $0.75

A total of 671 references to unclassified reports is presented on reactor systems, materials, and operation designed to provide maximum safety for the reactor, reactor personnel, and environs. Information is included concerning incidents and conditions of operation considered hazardous. Author, reactor, and report number-availability indexes are provided. Author (NSA)

N66-25997# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
FUEL SPACER DEVELOPMENT
George W. Richardson Nov. 1965 31 p refs
(Contract AT(07-2)-1)
(DP-1002) CFSTI: HC $2.00/MF $0.50

Full-length Zircaloy ribs, permanently attached to Zircaloy-clad fuel or to Zircaloy housing tubes and sized to produce minimum clearances, provide a reliable, proven method of spacing large, concentric nuclear fuel pieces to insure their integrity during power reactor operation. Author (NSA)

N66-25998# Hanford Atomic Products Operation, Richland, Wash.
FUEL CONSERVATION INDEXES FOR THERMAL REACTORS
E. A. Eschbach, M. F. Kanninen, and W. I. Nesf Jul. 1964 76 p refs
(Contract AT(45-1)-1350)
(HW-79287) CFSTI: HC $3.00/MF $0.75

An attempt is made to analyze the various factors involved in uranium conservation, and to derive a general set of indexes to measure the conservation efficiency of various reactors. A 7090 program listing in FORTRAN II is appended. Author (NSA)

N66-25999# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
ICPP PROCESSING OF VBWR STAINLESS STEEL FUEL (APRIL 14 TO JUNE 2, 1965)
R. W. Legan, N. Kormanik, and B. R. Wheeler Dec. 1965 42 p refs
(Contract AT(10-1)-205)
(IDO-14658) CFSTI: HC $2.00/MF $0.50

A method for processing high-enriched stainless steel–uranium alloy fuel elements from the Vallecitos Boiling Water Reactor is reported. Some of the capabilities of the plant and the process chemistry are discussed. Author (NSA)

N66-26000# California Univ., Livermore. Lawrence Radiation Lab.
THE FLOSS IV COMPATIBLE PROGRAMS, INCLUDING PROCEDURES FOR THE REAL GASDYNAMIC, ONE-DIMENSIONAL PERFORMANCE ANALYSES OF NUCLEAR RAMJET AND ROCKET ENGINES
Michael D. Mintz 28 Sept. 1965 132 p refs
(Contract W-7405-ENG-48)
(UCRL-7644) CFSTI: HC $4.00/MF $1.00

The aerothermodynamic behavior of compact heat exchangers as applied to vehicle propulsion systems is analyzed in terms of compatible one-dimensional models of the various system components. The methods of calculation are presented by means of simple logic flow diagrams which are based upon real gas properties and processes. The described methods are incorporated in a versatile digital computer program which computes total system aerothermodynamic performance, subject to a number of input options relating to overall system boundary conditions and heat exchanger design criteria. A complete FORTRAN II code listing and instructions for operation are presented for this program. The code is memory-contained and has been run on both the IBM 7090 series and CDC 3600 and 6600 digital computers. Author (NSA)

N66-26001# Radiation Research Associates, Inc., Fort Worth, Tex.
SIMPLIFIED METHODS FOR CALCULATING THE PENETRATION OF NEUTRON AND GAMMA RADIATION INTO UNDERGROUND CONCRETE STRUCTURES
D. G. Collins, R. L. French, L. G. Mooney, K. W. Tompkins, and M. B. Wells 25 Nov. 1964 40 p refs Presented at 1964 Winter Meeting of the Am. Nucl. Soc., San Francisco, 30 Nov.–3 Dec. 1964 Prepared for Oak Ridge Natl. Lab.
(Contract W-7405-ENG-26)
(RRA-M45; CONF-654-95) CFSTI: HC $2.00/MF $0.50

The analysis of two experiments provides a basis for the development and evaluation of simplified methods for predicting the prompt weapons radiation intensities inside underground concrete structures. One experiment mapped the radiation inside two concrete bunkers with an interconnecting tunnel located in a hillside approximately 700 feet from the source. The other experiment mapped the radiation in concrete-lined cylindrical holes at distances of 100, 228, and 450 feet from the reactor. In both experiments the openings of the undergound structures were shielded with various thicknesses of concrete. Albedo methods were developed for calculating neutron and gamma-ray reflection from the concrete walls of the structures and for calculating gamma dose rates due to thermal neutrons captured in the walls. Penetration calculation methods which consider the energy and angular distributions of the incident and emergent radiations were also developed. Most of the simplified methods are based on systematization of Monte Carlo data. Except for the problem of predicting thermal neutron fluxes for use in secondary gamma calculations, the overall calculation approach appears adequate. Author (NSA)

N66-26004# Battelle-Northwest, Richland, Wash.
SWISSCHEESE: A 7090 FORTRAN IV CODE FOR THERMAL-HYDRAULIC ANALYSIS OF GAS-COOLED NUCLEAR REACTORS
C. E. Leach Oct. 1965 99 p refs
(Contract AT(45-1)-1830)
(BNWL-147) CFSTI: HC $3.00/MF $0.75

The computer program SWISSCHEESE developed for the analysis of fluid flow and heat transfer in gas-cooled axial-flow reactors is described. The reactors are taken to be right-circular cylinders pierced by an arbitrary number of coolant passages. NSA

N66-26005# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
FUNDAMENTALS IN THE OPERATION OF NUCLEAR TEST REACTORS. VOLUME 5: ADVANCED TEST REACTOR DESIGN AND OPERATION
Nov. 1965 171 p
(Contract AT(10-1)-205)
(IDO-16871-5) CFSTI: HC $5.00/MF $1.00

A detailed description is presented of the Advanced Test Reactor and its associated facilities. Control components and instrumentation are described. Operating and shutdown procedures are discussed. Other detailed information is presented on supplementary water systems, liquid waste systems, electrical systems, heating and ventilation systems, radiation protection and monitoring, radiation monitoring system, and canal operations. NSA

N66-26035# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
USE OF PLUTONIUM AS A FUEL IN NUCLEAR REACTORS Quarterly Report No. 5, 1 Jan.–31 Mar. 1965
May 1965 36 p refs Transl. into ENGLISH from French
(Contract EURATOM-001-64-1 TRUB)
(EURAEC-1505; EUR-2883; BN-6505-01) CFSTI: HC $2.00/MF $0.50

Further development of PuO_2–UO_2 fuels for the BR-3/Vulcain reactor is discussed in terms of the following: fabrication of powders, fabrication of elements, fabrication methods and control, irradiation testing in the BR-2, BR-3/PWR, and BR-3/Vulcain reactors. Some post irradiation test results are discussed. Space-time measurements were made of the axial and radial diffusion in aluminum-water lattices. Various geometries were used and the results for each are presented. NSA

N66-26036# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
USE OF PLUTONIUM AS A FUEL IN NUCLEAR REACTORS Quarterly Report No. 6, 1 Apr.–30 Jun. 1965
Aug. 1965 60 p refs Transl. into ENGLISH from French
(Contract EURATOM-001-64-1 TRUB)
(EURAEC-1506; EUR-2884) CFSTI: HC $3.00/MF $0.75

Fabrication of PuO_2–UO_2 fuels for the BR-3/Vulcain reactor is discussed. The fuels were irradiation tested in the hydraulic conveyor HR-1 of the BR-2 reactor, in a boiling water capsule, and in the BR-3/Vulcain power reactor. Detailed results are presented for the first above test. NSA

N66-26081# Aerojet-General Nucleonics, San Ramon, Calif.
ARMY GAS-COOLED REACTOR SYSTEMS PROGRAMS Program Final Report
Mar. 1966 190 p refs
(Contract AT(10-1)-880)
(IDO-28655) CFSTI: $6.00

The technical accomplishments under the Army gas-cooled reactor systems program are summarized. A brief

chronology of the evolution of the program, including the reactor development activity, the design, fabrication and subsequent testing of the ML-1 nuclear power plant and related technological and engineering activities are discussed. The summary is supplemented by a comprehensive bibliography which includes a brief abstract of each referenced report or document. Author

N66-26229# Los Alamos Scientific Lab., N. Mex.
THE BEHAVIOR OF COATED PARTICLES IN A LARGE NUCLEAR TRANSIENT (KIWI TNT)
W. U. Geer, C. G. Hoffman, and J. F. Kerrisk 21 Jan. 1966 86 p
(Contract W-7405-ENG-36)
(LA-3367) CFSTI: HC $3.00/MF $0.75

Capsules containing extruded graphite fuel samples, loaded with 19 different types of coated particles, were exposed to the neutron pulse generated by the Kiwi Transient Nuclear Test (Kiwi TNT). The effects of flux, particle core material (UC_2 and UO_2), core diameter, coating thickness, and sample temperature on the graphite matrix damage and the coated particle damage were investigated. Visual, metallographic, and radiographic examination of the recovered samples produced the following conclusions: the total energy deposition was by far the most significant variable giving complete destruction of the samples at the highest energy depositions and little or no change at the lowest; particles with large core sizes showed more damage than those with small cores; neither coating thickness nor sample temperature significantly affected damage; and particles with UO_2 cores were more easily damaged than those with UC_2 cores. Author (NSA)

N66-26352# Armed Forces Radiobiology Research Inst., Bethesda, Md.
A DETAILED DERIVATION OF THE COURANT-WALLACE EXPRESSIONS FOR THE SECOND MOMENTS OF THE NEUTRON PROBABILITY DISTRIBUTION AND FOR THE VARIANCE/MEAN RATIO
Horace Schow, II Oct. 1965 32 p ref
(AFRRI-TN-65-1; AD-630698) CFSTI: HC $3.60/MF $0.50

A detailed mathematical derivation and verification of the three Courant-Wallace expressions, which have the three second moments of the neutron probability distribution in a pile as the three unknowns, are given. The solution of these equations for a steady pile with one equivalent delayed neutron group for the variance/mean ratio is verified. Minor corrections to the original Courant-Wallace text are noted. Author (TAB)

N66-26474# Societa Ricerche Impianti Nucleari, Saluggia (Italy).
INFLUENCE OF NITROGEN IN IRON AND STEEL UNDER FAST NEUTRON IRRADIATION Eighth Quarterly Report, 1 Jul.–30 Sep. 1965
F. Rossi Nov. 1965 9 p refs
(Contract EURATOM-004-63-10TEEI(RD))
(EURAEC-1529; EUR-267.f) CFSTI: HC $1.00/MF $0.50

Tests were made on unirradiated, irradiated, and irradiated plus annealed materials. Tests on N_2 enriched Fe, before and after irradiation, gave a good agreement with literature results, while Fe–Ti alloys data do not seem to fit the Petch and Hall equation. Author (NSA)

N66-26498# Naval Ordnance Lab., White Oak, Md.
TRANSFORMATIONS FOR SCALING OF CLOSE-IN PRESSURES FROM NUCLEAR EXPLOSIONS
Morton Lutzky and Delbert L. Lehto 9 Mar. 1966 18 p refs
(NOLTR-66-12; AD-630654) CFSTI: HC $1.60/MF $0.50

This report presents scaling methods for pressure distance curves for a simplified model of a nuclear explosion. It is found that different scaling variables are useful in different regimes, one set yielding a single dimensionless curve in the close-in region, while another set yields a single curve in the limit of large distances. These scaling methods are exact for an ideal gas, except for deviations caused by the second shock. For real air, additional discrepancies are introduced but the scaling is still sufficiently accurate to be useful. Author (TAB)

N66-26593 Office of Naval Intelligence, Washington, D. C. Translation Section.
NEW MATERIALS IN ENGINEERING.
Ye. I. Bel'skiy [1964] 20 p refs Transl. into ENGLISH from Russian
(ONI-TRANS-1089; TT-66-60266; AD-626701) CFSTI: HC $1.00/MF $0.50

Contents: the most important trends in science and engineering and new materials; rare materials and titanium; materials of nucleonics and radioactive isotopes; materials and powder products; polymer materials, plastics. (TAB)

N66-26757*# Aerojet-General Corp., Sacramento, Calif.
CENTERBODY DIFFUSER STUDY
Oct. 1965 124 p refs
(Contract SNP-1)
(NASA-CR-75221; RN-S-0243) CFSTI: HC $4.00/MF $1.00 CSCL 21F

In order to determine the feasibility of water-cooled centerbody diffusers for nuclear rocket application, nine different scale model centerbody configurations were fabricated and tested. The models included three nose cone sizes, and for each nose cone size three different cone frustrums were designed; the nose cones varied by the magnitude of their half-angle. Testing was conducted using the pressure blowdown system in series with a large stored energy heater to supply the gaseous nitrogen to the 1/15 size NERVA II nozzle. The following aerodynamic and thermodynamic results were obtained: For the range tested, nose cone angles and radii seemed to have no noticeable influence on the ejector starting pressure. With the use of a correlation factor of 1.15, the starting pressure ratio can be predicted by means of the conventional normal shock theory. It was proven that a full scale, water-cooled centerbody diffuser can be built. A theoretical investigation of heating rates involving the spherical tip, the cone frustrum, the transition point cone-to-sphere, and the mounting struts of the centerbody for laminar and turbulent flow, revealed that the absolute maximum heating rate is located at the sonic point, i.e., a spot on the spherical segment under turbulent flow conditions about 41° from the forward stagnation point. D.T.

N66-26785# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
NUCLEAR TECHNOLOGY BRANCHES Quarterly Report, 1 Jan.–31 Mar. 1965
Dec. 1965 89 p refs
(Contract AT(10-1)-205)
(IDO-17104) CFSTI: HC $3.00/MF $0.75

ATRC measurements in the A and B holes using zinc as a detector showed that the maximum fast flux in the ATR operating with a 40–50–60 MW power split will be 4.1×10^{14} n/cm^2 sec. Other ATRC measurements showed that the accidental voiding of a flux trap will produce a reactivity effect less than one dollar. Irradiation of aluminum cermet

fuels of interest to high performance test reactors continued in the PAED-G-12 ETR water loop. Temperature measurements obtained during ETR Cycle 69 showed an alumina formation rate corresponding to that measured in ex-reactor experiments. Post-irradiation annealing tests on aluminum-clad sample fuel plates indicate that blistering occurs at considerably lower temperatures for oxide fuels than those containing the uranium–aluminide intermetallic compound. Prototype MTR and ETR fuel elements using powdered UAl_3 as a fuel material have performed satisfactorily in the reactor. Beryllium irradiated at 750°C to an integrated flux of 7.5×10^{20} n/cm^2>1 MeV shows little increase in compression yield strength and a decrease in ultimate compression strength and ductility. There is a release of gas from the beryllium of 0.223 cc He (STP) per cc beryllium. The application of the microprobe to the examination of irradiated fuel materials to determine the presence and distribution of fission products and plutonium was continued and extended. An unirradiated PuO_2-nichrome cermet fuel material was also examined. The study of the decay of Nd-149 was essentially completed. Energies of intensities are reported for conversion electrons and gamma-ray transition. Experimental and theoretical conversion coefficients are compared. A decay scheme is proposed. Two problems were studied on the analog computer. The first was concerned with the primary coolant system of the proposed Experimental Organic Cooled Reactor, and the second was a study of the design parameters of air pulsers used with extraction pulse columns at the Idaho Chemical Processing Plant (ICPP). In addition to these studies, a tape programmer for the In-Pile Fatigue Tester; a high-speed, ultra-reliable, pulse-counting system for use in the critical facilities; and instrumentation required for the detection, amplification, and counting of fringes produced by a gas-phase laser mirror combination were developed. NSA

N66-26790# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.

IRRADIATION BEHAVIOR OF Zr-U DRIVER TUBES FOR HWCTR

Carl L. Angerman and George R. Caskey, Jr. Oct. 1965 24 p refs

(Contract AT(07-2)-1)

(DP-994) CFSTI: HC $1.00/MF $0.50

The HWCTR was fueled with enriched uranium tubes of Zr–9.3 wt % U alloy clad with Zircaloy-2 by coextrusion. Irradiation of these tubes up to 1.83 atom % burnup at temperatures up to 540°C and under 1200 psi coolant pressure resulted in volume increases up to 5%, only about half of the amount predicted by published data. The volume increases were caused by the formation of solid fission products and the precipitation of fission gases in small bubbles. Author

N66-26803# Atomic Energy Commission, Washington, D. C. Fuels and Materials Development Branch.

NUCLEAR FUELS AND MATERIALS DEVELOPMENT

William L. R. Rice, ed. Jun. 1965 146 p refs

(TID-11295 (Pt. 1, 4th Ed.))

Work performed under the Advanced Reactor Technology program of the Division of Reactor Development and Technology, materials projects authorized by the U.S.–Euratom Joint Research and Development Board, and other related materials developments during the calender year 1964 are summarized. Work is identified by site, rather than topic. NSA

N66-26804# Atomic Energy Commission, Washington, D. C. Div. of Reactor Development and Technology.

SUMMARIES OF FUELS AND MATERIALS DEVELOPMENT PROGRAMS MATERIALS RESEARCH UNDER REACTOR PROGRAMS

William L. R. Rice, ed. May 1965 84 p refs

(TID-6508 (Pt. 2, 3rd Ed.)) CFSTI: HC $3.00/MF $0.75

The research is identified by the reactor project. The contractors are listed alphabetically and a subject index is included. For those contracts having a number of tasks with separate objectives, each task is summarized separately. Author (NSA)

N66-26806# IIT Research Inst., Chicago, Ill.

STUDIES OF REACTOR CONTAINMENT STRUCTURES Summary Report, 1 Feb. 1963–30 Jun. 1964

M. A. Salmon, R. L. Chiapetta, and F. L. Schuyler [1965] 356 p refs

(Contract AT(11-1)-578)

(IITRI-578P22-14) CFSTI: HC $7.00/MF $1.50

The following areas of reactor containment structures were investigated: analysis of the response of containment vessels, the effect of openings on the strength of containment vessels, and the behavior of cylinders of finite length under internal pressure. Data on the mechanical properties of materials, plastic strength of thin cylindrical shells with various end closures under internal pressure, and the transmission and attenuation of disturbances in generalized media are discussed. NSA

N66-26807# Combustion Engineering, Inc., Windsor, Conn.

BOILING NUCLEAR SUPERHEATER (BONUS) POWER STATION—STARTUP Summary Report, Feb. 1964–19 Dec. 1966

Feb. 1966 654 p Prepared Jointly with Puerto Rico Water Resources Authority

(Contract AT(40-1)-2672; AT(40-1)-2674)

(CEND/PRWRA-257) CFSTI: HC $9.00/MF $2.50

The startup and initial operation of the BONUS power plant are summarized. The nuclear and thermal characteristics of the integral boiling superheater core, the performance of the auxiliary and emergency systems of the reactor, the performance of the generating part of the plant, and the problems that had to be resolved for the various systems and controls during the startup period are discussed. NSA

N66-26808# Argonne National Lab., Ill.

REACTOR DEVELOPMENT PROGRAM Monthly Progress Report, Nov. 1965

27 Dec. 1965 110 p refs

(Contract W-31-109-ENG-38)

(ANL-7122) CFSTI: HC $4.00/MF $0.75

Significant technical progress occurring in specific reactor projects and in general engineering research and development programs are reported. These include the experimental breeder reactor-II, the zero power reactor-3, and the zero power plutonium reactor projects; and the plutonium recycle program for the experimental boiling water reactor. Accomplishments in such areas as operation, maintenance, fabrication, and modifications are reported. C.T.C.

N66-26809# Argonne National Lab., Ill.

A PRELIMINARY EVALUATION OF THE USE OF HIGH-TEMPERATURE PROCESS HEAT AS PART OF A TOTAL NUCLEAR-ENERGY SOURCE

L. J. Gordon (Aerojet-Gen. Corp., Sacramento, Calif.) and J. F. Marchaterre Sep. 1965 54 p refs
(Contract W-31-109-ENG-38)
(ANL-7035) CFSTI: HC $3.00/MF $0.50

A preliminary study of the use of high-temperature (1500–3000°F) process heat as part of a multipurpose complex was carried out. The conclusions of the study indicate that in addition to conventional electric power generation, nuclear energy might be useful in alumina and aluminum production; in cement production as part of a complex; and in calcining and/or sintering ores such as taconite. The main factor that could make high-temperature, nuclear, process heat attractive is the potential of developing specially designed multipurpose reactors. The multipurpose reactor appears to be a possible way in which high temperature process heat could be economically supplied. Most uses of high-temperature process heat that appear attractive would necessitate the development of heat exchangers to heat air to 2200–2700°F.
Author (NSA)

N66-26814# Hanford Atomic Products Operation, Richland, Wash.
PROGRAMMED TUBE TO TUBESHEET WELDING ON HANFORD HEAT EXCHANGERS USED IN NUCLEAR PROCESSING SERVICE
L. B. Bradley Jan. 1966 26 p refs
(Contract AT(45-1)-1851)
(RL-SEP-710) CFSTI: HC $1.00/MF $0.50

The welding sequence of a typical automated TIG weld of the type 304L stainless steel components is given. The wiring diagram of the variable program weld controller is included.
NSA

N66-26815*# Oak Ridge National Lab., Tenn. Radiation Shielding Information Center.
BIBLIOGRAPHY, SUBJECT INDEX, AND AUTHOR INDEX OF THE LITERATURE EXAMINED BY THE RADIATION SHIELDING INFORMATION CENTER—SPACE AND ACCELERATOR SHIELDING
J. Gurney, ed. Nov. 1965 74 p refs
(NASA Order R-104; Contract W-7405-ENG-26)
(NASA-CR-75316; ORNL-RSIC-11) CFSTI: HC $3.00/MF $0.75 CSCL 18F

The bibliography contains only articles of the review or summary type and deals with the primary areas of space radiation sources, cross section data, particle transport, and shielding.
NSA

N66-26821*# Lockheed-Georgia Co., Dawsonville. Nuclear Labs.
HOT CELL RADIATION TESTING AND INSPECTION
[1965] 28 p ref
(Contract NAS8-5332)
(NASA-CR-75302) CFSTI: HC $2.00/MF $0.50 CSCL 18F

A description is given of hot cell inspection and testing which was conducted to assure that the radiation shielding requirements were met in the construction of a hot cell complex. This was accomplished by measuring the amount of radiation leakage external to the cells from cobalt-60 radiation sources placed within the cells.
C.T.C.

N66-26822*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
EXPERIMENT DESIGN MANUAL AND HAZARDS ANALYSIS—PLUM BROOK REACTOR FACILITY
May 1964 52 p refs
(NASA-CR-75303; WANL-TNR-119, Rev. 1) CFSTI: HC $3.00/MF $0.50 CSCL 18I

A design manual and hazards analysis are presented for an in-pile water-cooled capsule in the HT-1 tube of the Plum Brook reactor facility. The basic purpose is to provide information which will assist in the selection of materials and components for incorporation in the NERVA reactor experiment (NRX). The water-cooled capsule tests required items in a high radiation environment, and is considered the closest available to the actual NRX levels. A primary consideration is that many of the radiation effects which are of importance are those associated with dose rate rather than total integrated dose.
C.T.C.

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N66-25592# Royal Inst. of Tech., Stockholm (Sweden).
TABLES OF THE MAGNETIC FIELD FROM A CIRCULAR CURRENT LOOP
Bjorn Bonnevier Apr. 1964 30 p refs *Its* Trans. No. 235, Elec. Eng. 14
CFSTI: HC $2.00/MF $0.50

Tables are presented which give the flux function, the components, and the resultant magnitude of the magnetic flux density in the magnetic field surrounding a circular current loop.
Author

N66-25615# Harry Diamond Labs., Washington, D. C.
EXACT SOLUTIONS FOR A SEMI-INFINITE SQUARE LATTICE GAS
N. Karayianis, C. A. Morrison, and D. E. Wortman Feb. 1966 24 p refs
(HDL-TR-1314; AD-630167) CFSTI: HC $2.60/MF $0.50

The problem of a two-dimensional lattice gas with nearest neighbor infinite repulsion is considered by obtaining exact solutions for a sequence of semi-infinite spaces. The exact solutions are obtained for M × infinity spaces with 2 < or = M < or = 14 in even steps, and although there are no phase transitions in these spaces, a criterion for the point of 'closet approach' to a phase transition is established. The values of the thermodynamic variables evaluated at this point for each M are extrapolated to obtain the properties of the two-dimensionally infinite space. The data indicate a third-order phase transition occurring with probably infinite compressibility at an activity z=3.799, a density=0.7356, and a pressure=0.7914. The density is obtained by a rigorous differentiation of the secular determinant that determines the values of the pressure for a given z, thus securing the accuracy of the calculations and enabling the extrapolated values of the thermodynamic variables to be estimated with good precision.
Author (TAB)

N66-25640# Consiglio Nazionale delle Ricerche, Rome (Italy). Istituto Nazionale di Ultracustica O. M. Corbino.
DOCUMENTATION OF ULTRAACOUSTICS, RELATIVE TO 1960 [DOCUMENTAZIONE DI ULTRACUSTICA RELATIVA ALL'ANNO 1960]

[1965] 52 p refs In ITALIAN
CFSTI: HC $3.00/MF $0.50

An annotated bibliography is presented of ultrasonics literature published in 1960. Areas of classification include: (1) the effects of ultrasonic waves on photon radiation; (2) ultrasonic instruments; (3) ultrasonic velocities, dispersion, and absorption in gases, solids, and liquids; and (4) the physical, chemical, and biological effects of ultrasonic waves.
Transl. by D.T.

N66-25646# Japan Broadcasting Corp., Tokyo.
REQUIREMENTS FOR ABSORPTION COEFFICIENT TO REDUCE COLORATION IN SMALL TALKS STUDIOS
Teruji Yamamoto Nov. 1965 27 p refs
(S-4) CFSTI: HC $2.00/MF $0.50

The resonance effect of audible low frequencies in small talks studios often results in the worst nuisances known as "coloration". In many cases, this is due to the excitation of the axial mode of vibration with a small damping coefficient, which exists separately in the neighboring modes. To determine the value of the wall absorption coefficient of small talks studios, hearing tests were conducted for just the perceptible limit of the coloration in terms of Q values of the relating axial mode and the ratio (D) of the excited level of the mode to those of the modes in medium and high frequency ranges. For the tests, four listeners were subjected to assessment of speech signals with various degrees of coloration reproduced through a selective amplifier as a simulator of transmission characteristics of small talks studios. From the Q value and the ratio (D) obtained for just the perceptible limit of the coloration at 70 c/s, 90 c/s and 130 c/s, it was shown that the absorption coefficient of the wall relating to the axial mode for unperceptible coloration should be larger than 0.33 for a studio of six cubic meters, and that the absorption coefficient decreases as the volume increases.
Author

N66-25675# Brown Univ., Providence, R. I. Div. of Engineering.
ATTENUATION AND DISPERSION OF SOUND BY PARTICULATE RELAXATION PROCESSES
S. Temkin Feb. 1966 37 p refs
(Contract Nonr-562(37))
(AD-630326)

The temperature and velocity of a particle suspended in an acoustic field are subject to fluctuations which may lag behind those of the surrounding fluid. A theory for acoustic attenuation and dispersion in an aerosol based on these particulate relaxation processes is given. The close relationship between particulate relaxation and relaxation mechanisms due to lagging molecular or atomic internal degrees of freedom is displayed. The particulate relaxation theory predicts attenuation and dispersion by small, heavy particles in close agreement with existing, more detailed theories, for values of circular acoustic frequency and dynamic relaxation time of the particle smaller than and including order unity. Comparison with existing experimental data of attenuation and dispersion due to Zink and Delsasso shows good agreement.
Author

N66-25808# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
USE OF MAGNETIC SUSPENSION SYSTEM IN O.N.E.R.A. WIND-TUNNEL [UTILISATION DES DISPOSITIFS DE SUSPENSION MAGNETIQUE DANS LES SOUFFLERIES DE L'O.N.E.R.A.]
Roland Moreau [1966] 86 p refs In FRENCH and ENGLISH Presented at the Symp. on Magnetic Suspension, Wright-Patterson AFB, Ohio, 13-14 Apr. 1966
(TP-341(1966)) CFSTI: HC $3.00/MF $0.75

Past work and experiments using magnetic suspension systems is reviewed. The present state-of-the-art for these systems is described; and some of the difficulties discovered in the course of development and adaptation to hypersonic wind tunnels are discussed, along with their solutions. It is pointed out, that the main drawback to the use of a magnetic suspension system is the power level requisite for its operation. It is suggested, however, that the application of superconductivity principles and techniques may overcome this problem. Finally, the system is particularly recommended for the study of hypersonic wakes.
D.T.

N66-25910# Catholic Univ. of America, Washington, D. C.
NUMERICAL DISCUSSION OF CREEPING ACOUSTICAL WAVES AROUND CYLINDERS. SOUND SCATTERING BY ELASTIC CYLINDRICAL SHELLS
H. Uberall, R. D. Doolittle, and J. V. Mc Nicholas Dec. 1965 29 p refs *Its* Underwater Acoustics Program Rept.-2-65
(Contract Nonr-2249(08))
(AD-630033) CFSTI: HC $2.60/MF $0.50

The report presents the solution for the scattered field corresponding to a plane sound wave incident upon an infinite elastic circular-cylindrical concentric shell, imbedded in a fluid and enclosing another fluid. The results are shown to contain the known special cases of fluid and elastic solid cylinders. Furthermore, limiting expressions for long wavelengths are obtained in special cases. The second part of this report is a sequel to a previous report (AD-625 793) 'Pulsed Creeping Waves in Acoustics', which discussed diffraction of sound waves and pulses by cylinders. Graphical illustrations are presented of some aspects of the creeping waves, in particular their velocities and damping for rigid and soft cylinders, the backscattering cross section for rigid cylinders, and the shape of the head of the diffracted pulses. It is found that only very few creeping waves already give an excellent approximation to the exact solution for large and even moderately large values of ka.
Author (TAB)

N66-25922# RAND Corp., Santa Monica, Calif.
SOME NUMERICAL ASPECTS OF UNSTABLE BOUNDARY-VALUE PROBLEMS
R. E. Kalaba Mar. 1966 25 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4944-PR; AD-630266) CFSTI: HC $1.00/MF $0.50

In various fields of application, including radiative transfer and automatic control, there is a need to integrate unstable linear systems of ordinary differential equations subject to two-point or multipoint boundary conditions. Special precautions must be taken to prevent the deleterious effects of the instability from manifesting themselves. The use of imbedding techniques, Laplace transforms, and concepts from control theory itself can prove efficacious, as some examples in this memorandum show.
Author (TAB)

N66-25924# RAND Corp., Santa Monica, Calif.
A NEW INITIAL VALUE METHOD FOR INTERNAL INTENSITIES IN RADIATIVE TRANSFER
H. H. Kagiwada and R. E. Kalaba Mar. 1966 24 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4906-PR; AD-630121) CFSTI: HC $1.00/MF $0.50

An improved technique is presented for determining internal intensities for transport processes in finite slabs where absorption and multiple scattering occur. Traditional approaches involve solving either an unstable linear two-point boundary-value problem or a singular integral equation, both of which have computational drawbacks. This new method, however, has computational and analytical advantages, for it leads to the integration of an initial value problem for a system or ordinary differential equations, a suitable task for digital computers. Some typical results are presented as well as comparisons against other calculations. The authors also show how certain problems involving two-point boundary conditions or singular intergral equations can be converted into stable initial-value problems, a major step in mathematical physics and engineering. Author (TAB)

N66-25940# RAND Corp., Santa Monica, Calif.
BEARING ANGLE ESTIMATION OF ATMOSPHERIC SONIC PLANE WAVES USING GROUND ARRAYS
M. Blum Feb. 1966 62 p refs
(Contract ARPA SD-79; ARPA Order 189-61)
(RM-4898-ARPA; AD-630422) CFSTI: HC $3.00/MF $0.75

A presentation of data processing techniques developed to obtain bearing angle estimates of plane sonic waves using arbitrary ground arrays of microphones. The evaluation of the accuracy obtainable as measured by the rms bearing angle error is computed in detail for a proposed 16-station square array for use in the VELA detection system. A novel feature of the method is that the ground trace velocity of sound need not be already known or measured independently, but can be derived from the same measurements as the bearing angle. Author (TAB)

N66-26012# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ANALYTICAL PROPERTIES OF EUCLIDEAN AMPLITUDES [ANALITICHESKIE SVOISTVA EVKLIDOVYKH AMPLITUD]
G. V. Efimov 1965 19 p refs In RUSSIAN
(JINR-P-2485)

The Cutkosky rule is proved for normal thresholds in the case of arbitrary Feynman graphs in the Euclidean formulation of quantum field theory. Author (NSA)

N66-26030# Iowa State Univ. of Science and Technology, Ames.
A COMPARISON OF RARE-EARTH CATHODES IN A DIODE ION PUMP
Peter Klaus Lorenz (M.S. Thesis) Nov. 1965 55 p refs
(Contract W-7405-ENG-82)
(IS-T-48) CFSTI: HC $3.00/MF $0.50

The performance of diode ion pumps with yttrium, neodymium, erbium, and ytterbium cathodes is compared with a pump in which titanium is the cathode material. All of the pumps used in the study used an egg-crate shaped anode constructed of titanium. Performance tests were made with nitrogen, oxygen, argon, carbon dioxide, air, hydrogen, and methane. In general, ytterbium, yttrium, and erbium are more effective in pumping air, nitrogen, methane, carbon dioxide and oxygen than is titanium. Yttrium is more effective than titanium for pumping hydrogen. All of the rare-earth metals are more effective than titanium for pumping argon at pressures above 5×10^{-9} torr. No periodic pumping instability for argon was observed with neodymium, erbium, or ytterbium cathodes. One serious drawback to the use of ytterbium cathodes is the high erosion rate of the cathode under ion bombardments. Author (NSA)

N66-26032# Iowa State Univ. of Science and Technology, Ames.
ON THE MECHANISM OF ELECTROOSMOSIS IN LIQUID METALS
D. K. Belashchenko [1965] 4 p ref Transl. into ENGLISH from Zh. Fiz. Khim. (Moscow), v. 39, 1965 p 808-809
(IS-TRANS-26) CFSTI: HC $1.00/MF $0.50

Equations are given to show that the electroosmosis effect may be measured by the speed of transfer of a liquid from one communicating (connected) container into another with the same levels in them. The electroosmotic effect under consideration allows the speed of the charge carriers and their sign to be measured directly and may be applied for analysis of the state of the electrons in liquid solutions. Its distinguishing characteristic trait is the proportionality of the effect to the square of the current density. NSA

N66-26110# Joint Publications Research Service, Washington, D. C.
ATTENUATION OF OPTICAL RADIATION WHEN PASSING THROUGH DUSTY ATMOSPHERE
A. S. Gridin and T. A. Yarlykova *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 148-153 refs (See N66-26086 14-14) CFSTI: $6.00

The article cites results of theoretical and experimental investigations on the determination of the passage coefficients of optical radiation through dusty atmosphere. The formula for the passage coefficient is derived. Results of experimental checks of this formula are given. Author

N66-26168# Chalmers Univ. of Technology, Goteborg (Sweden).
ON THE SURFACE ACTIVITY OF SOLID BODIES [UBER DIE AKTIVITAT DER OBERFLACHEN FESTER KORPER]
J. Arvid Hedvall 1965 13 p refs In GERMAN *Its* Trans. No. 304 CFSTI: HC $1.00/MF $0.50

The state-of-the-art of surface structure and activity of solid bodies is discussed, including updated definition of electron and particle movement in phase boundaries, chemophysical interaction, grid structure and characteristics, crystallography, and the thermic effects. Brief reference is made to the reaction of solids to other solids, liquids, and gases, and to the role of oxide coatings in reducing movement of surface particles. The effect of adsorbable light waves on crystals is mentioned and the resulting extension of the term photochemistry is pointed out. Magnetic and ultrasonic effects on metals are also briefly cited. Transl. by K.W.

N66-26186# International Centre for Theoretical Physics, Trieste (Italy).
THE MOST DEGENERATE REPRESENTATIONS FOR THE COMPACT AND NON-COMPACT ROTATION GROUPS
J. Niederle and R. Raczka Nov. 1965 18 p refs Submitted for Publication
(IC/65/89)

The most degenerate representations of any compact as well as non-compact rotation groups are considered and their properties are discussed in detail. The explicit construction of the corresponding harmonic functions is given. The coordinate systems are chosen in such a way that Cartan subalgebra of considered groups is diagonal and the harmonic functions are denoted only by discrete numbers except one. Author (NSA)

N66-26255*# IIT Research Inst., Chicago, Ill. Technology Center.
INVESTIGATION OF LIGHT SCATTERING IN HIGHLY REFLECTING PIGMENTED COATINGS Quarterly Report, Feb. 1–May 1, 1966
G. A. Zerlaut, B. H. Kaye, and M. R. Jackson 3 May 1966 43 p refs
(Contract NASr-65(07))
(NASA-CR-75644; IITRI-U6003-18) CFSTI: HC $2.00/MF $0.50 CSCL 20F

The continuing Monte Carlo investigations with respect to the growth of clusters of pigment particles as the pigment volume concentration is increased are reported. Plotting experiments were carried out to explore the criticism that the particle shape assumed in earlier studies is too symmetrical and that results from the plotting experiment are not valid because real pigment particles have nonsymmetrical shapes. The plots and a graph showing absolute number of scattering centers per unit volume are included. The factors tending to reduce and to increase cluster formation are discussed. It is suggested that it may not be possible to solve some problems associated with the optical properties of paint films until quantitative methods of shape analysis are developed. A critique of current concepts and studies pertaining to Mie theory is also presented. It was concluded that it is impracticable to apply the Mie theory to paint theory and practice. N.E.N.

N66-26285*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POWER SPECTRAL DENSITY ANALYSIS
Charles D. Hayes 15 Jun. 1966 16 p
(Contract NAS7-100)
(NASA-CR-75154; JPL-TR-32-928) CFSTI: HC $1.00/MF $0.50 CSCL 20C

This technical report develops the generalized techniques for determining the equation describing the power spectral density function (G^2/cps versus frequency etc.) and the equation for determining the root mean square of a power spectral density function. Examples of both types of equations are included in the appendix. Author

N66-26297# Wisconsin Univ., Madison. Mathematics Research Center.
ON AN INTEGRAL EQUATION IN ELECTROMAGNETIC DIFFRACTION THEORY
P. Werner Aug. 1965 28 p refs
(Contract DA-11-022-ORD-2059)
(MRC-595; AD-630532) CFSTI: HC $2.00/MF $0.50

This paper contains investigations on the integral equations which are of interest in the study of the behavior of totally reflected stationary electromagnetic wave fields as the frequency tends to zero. It is shown that both integral equations have exactly p linearly independent solutions where p is the topological genus of S. Author (TAB)

N66-26327# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE BEHAVIOR OF STATIONARY ELECTROMAGNETIC WAVE FIELDS FOR SMALL FREQUENCIES
P. Werner Feb. 1966 79 p refs
(Contract DA-11-022-ORD-2059)
(MRC-605; AD-630539) CFSTI: HC $3.00/MF $0.75

This paper contains investigations on the stationary electromagnetic field (E,H) which is generated by the reflection of a given incoming field at a finite number of simply connected perfectly conducting bodies. A method is described which allows us to discuss the behavior of the magnetic field H as the frequency tends to zero. This supplements previous investigations on the behavior of the electric field E for small frequencies. Several examples are considered in detail (frequency independent boundary data, reflection of electric and magnetic dipoles, reflection of fields generated by volume distributions of electric currents). Similar results are obtained for the corresponding interior boundary value problems, by applying a method which has recently been developed by R. C. MacCamy. Author (TAB)

N66-26342# Washington Univ., Seattle. Dept. of Electrical Engineering.
TRANSIENTS IN MAGNETO-IONIC MEDIA AND INTERRELATIONS BETWEEN ORDINARY AND EXTRAORDINARY WAVE REPRESENTATIONS
Akira Ishimaru Dec. 1965 69 p refs *Its* Tech. Rept.-100
(Contract AF 19(628)-2763)
(AFCRL-66-68; AD-630704) CFSTI: HC $2.60/MF $0.50

For a time harmonic case, ordinary and extraordinary waves are independent modes in magneto-ionic media. However, for a transient, an inverse Laplace transform of the time harmonic solution of each mode does not yield a real function of time, and a special care, which is unnecessary for isotropic media, must be taken for magneto-ionic media. This paper discusses this aspect of the transient and shows a general form of the representations of the transient which clarifies the interrelations between ordinary and extraordinary wave representations. Author (TAB)

N66-26343# ARO, Inc., Arnold Air Force Station, Tenn.
A DISCUSSION OF ENERGY AND MOMENTUM TRANSFER IN GAS-SURFACE INTERACTIONS
R. E. Stickney Feb. 1966 69 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-13; AD-630522) CFSTI: HC $3.00/MF $0.75

The principal mechanisms of energy and momentum transfer between gas atoms and solid surfaces are considered for the range of impact energies encountered in high-speed flight (e.g., up to 10 ev). Included within are (1) introductory discussions of the nature of surfaces, intermolecular potentials, adsorption, and basic gas–surface interaction processes, (2) a critical survey of the definitions of energy and momentum accommodation coefficients, (3) summaries of existing theoretical and experimental results pertaining to the energy accommodation and directional distribution of atoms scattered from a surface, (4) an attempt to formulate the main parameters and regimes of gas–surface interactions, and (5) suggestions concerning future investigations. Author (TAB)

N66-26380# RAND Corp., Santa Monica, Calif.
INTERACTION ENERGY OF A DIELECTRIC IN AN ELECTROSTATIC FIELD
Victor Gilinsky and Dennis Holliday Mar. 1966 22 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4892-PR; AD-629919) CFSTI: HC $2.60/MF $0.50

A straightforward computation of the interaction field energy of a dielectric in a uniform external electrostatic field appears to yield a result different from that given by a general theorem. It is shown here that the discrepancy can be resolved by considering the uniform field of infinite extent to be the limit of a field of finite extent. A recent paper by M.S. Plesset and G. Venezian is discussed (Am. J. Phys. 32:860, (1964)). TAB

N66-26383# International Centre for Theoretical Physics, Trieste (Italy).
REMARKS ABOUT THE FUBINI–FURLAN METHOD
W. Krolikowski 4 Feb. 1966 9 p refs Submitted for Publication
(IC/66/8)

Some observations on the Fubini–Furlan approach to the algebra of currents and symmetry breaking are presented. Basic formulas of the Fubini–Furlan method are derived once more without meeting discomfort caused by group generators in remote past and future. A generalization of the condition for "partial conservation of axial vector currents" is gained, which still gives a link between group commutators and transition matrix elements and enables one to derive relations of the Adler–Weisberger type from the algebra of currents.
Author (NSA)

N66-26428*# Wisconsin Univ., Madison. Mathematics Research Center.
ON THE FEYNMAN INTEGRAL IN DYNAMICS
A. M. Arthurs Jan. 1966 14 p refs
(Grant NsG-275-62; Contract DA-11-022-ORD-2059)
(NASA-CR-75269; MRC-618; AD-630748) CFSTI: HC $1.60/MF $0.50 CSCL 20J

A Hamiltonian form of the Feynman integral is evaluated for the case of classical waves. The work of Corson on a unified formulation of dynamics is also discussed. Author (TAB)

N66-26432*# Wisconsin Univ., Madison. Mathematics Research Center.
ON ITERATIVE SOLUTIONS FOR QUANTUM-MECHANICAL BOUND STATES
Peter D. Robinson Jan. 1966 34 p refs
(Grant NsG-275-62; Contract DA-11-022-ORD-2059)
(NASA-CR-75270; MRC-609; AD-630542) CFSTI: HC $2.00/MF $0.50 CSCL 20J

Integral forms of Schrodinger's time-independent wave equation are considered, both in coordinate space (using free-particle Green's Functions) and in momentum space. Iterative solutions for bound states are investigated. Previous work is briefly discussed, and possibilities for future progress mentioned. Author (TAB)

N66-26468# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
MICROSTRUCTURAL EXAMINATION
M. L. Picklesimer Jan. 1966 24 p refs Presented at 3d Conf. on Thermal Conductivity, Gatlinburg, Tenn., 10–18 Oct. 1963
(Contract W-7405-ENG-26)
(ORNL-TM-1338; CONF-412-2) CFSTI: HC $1.00/MF $0.50

The ease of examination of the microstructures of specimens and its importance in the characterization of the specimens and in the interpretation of the data are discussed. Details of the methods of examination, equipment used, and techniques of quantitative microscopy are given. NSA

N66-26475# International Centre for Theoretical Physics, Trieste (Italy).
DIFFERENCE BETWEEN SOURCES AND CHARGES
W. Krolikowski 4 Feb. 1966 9 p refs
(IC/66/7)

It is argued that in the case of broken symmetries that concepts of sources and charges are entirely different and cannot refer to the same physical objects, in contradistinction to the familiar case of electrodynamics. The argument contradicts the conjecture of "spontaneous breakdown" of SU(3). A hypothesis of a "partial conservation of tensor current" is suggested. Author (NSA)

N66-26479# International Centre for Theoretical Physics, Trieste (Italy).
DISCRETE DEGENERATE REPRESENTATIONS OF NON-COMPACT ROTATION GROUPS
R. Raczka, N. Limic, and J. Niederle 24 Jan. 1966 38 p refs Submitted for Publication
(IC/66/2)

The discrete most degenerate principal series of irreducible unitary one-valued representations of an arbitrary non-compact rotation group SO(p,q) are derived. The properties of these representations are discussed and the explicit form of the corresponding harmonic functions is given.
Author (NSA)

N66-26484# International Centre for Theoretical Physics, Trieste (Italy).
MAXIMAL DEGENERATE SYSTEMS DYNAMICS
G. Bisiacchi and P. Budini (Inst. of Phys., Trieste Univ.) Feb. 1966 11 p refs Submitted for Publication
(IC/66/6)

It is shown that for a "maximal degenerate" system for which the energy multiplet built up a most degenerate representation of the symmetry group, the dynamical problem can be solved with purely group theoretic methods once the spectrum-generating algebra is known. The Casimir operator of this algebra can be reduced in terms of a Cartan operator of the symmetry algebra and of its Casimir operator; this fixes the energy spectrum, the dynamical equations, and Green functions for the system. The method is applied to the N-dimensional harmonic oscillator for which Sp(N,R) is the spectrum-generating algebra. Author (NSA)

N66-26503# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF ULTRASONIC ATOMIZERS OF LIQUIDS AND MELTS
V. P. Popov and G. K. Goncharenko 20 Jan. 1966 12 p refs Transl. into ENGLISH from Khim. Prom. (Leningrad), no. 6, 1964 p 442–445
(FTD-TT-65-1445/1+2+4; AD-629414) CFSTI: HC $1.00/MF $0.50

It was experimentally shown that the distribution of particles in the spray with respect to their diameter in the aggregate has a continuous character under the most diversified conditions of atomization. Therefore, the obtained system of drops can be examined as a static aggregate. TAB

N66-26533# Southwest Research Inst., San Antonio, Tex.
DUAL CHANNEL OPTICAL SYSTEM FOR USE WITH LOW VOLTAGE KERR CELL Final Report, 27 Apr.–31 Dec. 1965
Frank C. Whitmore, Robert E. Linder, and William W. Bradshaw Brooks AFB, Tex., School of Aerospace Med., 31 Dec. 1965 43 p
(Contract AF 41(609)-2709)
(AD-627245) CFSTI: HC $2.00/MF $0.50

A working model of a dual channel window has been constructed which, when used in conjunction with a low voltage Kerr cell, should provide a useful flash blindness protection device. This first-phase program has demonstrated that a

large area window structure using a dual-beam approach is feasible provided that an almost Brewster angle beam splitter arrangement is used with dual entrance windows. The resulting apparatus turns out to be too large to be applied to aircraft, but the size should not provide a serious limitation for such applications as ground vehicles. Some preliminary work is also reported which bears on the utility of thin layer liquid crystal systems for application as Brewster mirrors.
Author (TAB)

N66-26534# London Univ. (England). King's Coll.
INTERNATIONAL CONFERENCE ON RELATIVISTIC THEORIES OF GRAVITATION, VOLUME I
H. Bondi Jul. 1965 69 p refs Conf. held 1–10 Jul. 1965
(Grant AF-EOAR-21-65)
(ARL-66-0032; AD-629097) CFSTI: HC $6.60/MF $0.75

CONTENTS:
1. SOURCES OF EINSTEIN'S EARLY WORK IN RELATIVITY THEORY Gerald Holton (Harvard Univ.) 29 p refs
2. POST-NEWTONIAN HYDRODYNAMICS AND THE STABILITY OF GASEOUS MASSES S. Chandrasekhar (Chicago Univ.) 14 p refs
3. PHYSICS OF RELATIVISTIC COLLAPSE I. D. Novikov and Ja. B. Zeldovich 25 p refs
4. GRAVITATIONAL WAVES AND RADIATION Andrzej Trautman (Warsaw Univ.) 24 p refs
5. THE GRAVITATIONAL LENS EFFECT Sjur Refsdal (Oslo Univ.) 17 p refs
6. SPINORS M. Fierz 9 p

N66-26543# California Univ., La Jolla. Inst. for Radiation Physics and Aerodynamics.
RESEARCH IN RADIATION PHYSICS AND AERODYNAMICS Semiannual Technical Summary, Period Ending Mar. 30, 1966
Keith A. Brueckner 30 Mar. 1966 8 p refs
(Contract DA-31-124-ARO(D)-257; ARPA Order 570; Proj. Defender)
(AD-631070) CFSTI: HC $1.10/MF $0.50

Abstracts are presented of technical papers on the following subjects: atomic and molecular physics, laser beam interactions, high temperature gas dynamics, solid mechanics and structures, fluid mechanics, plasma physics and diagnostics, numerical analysis and applied mathematics. TAB

N66-26544# Harvard Univ., Cambridge, Mass. Acoustics Research Lab.
CAVITATION DYNAMICS. I: A MATHEMATICAL FORMULATION
H. G. Flynn Jan. 1966 67 p refs Prepared in cooperation with Rochester Univ.
(Contracts Nonr-1866(24); Nonr-668(18))
(TM-50; AD-631016) CFSTI: HC $3.00/MF $0.75

A central problem in the study of acoustic cavitation is that of understanding the dynamics of small, isolated bubbles set in motion in a liquid by a sound field. The complicated, nonlinear nature of such motions has served in the past to limit investigations to the study of very simple models of such bubbles. However, the advent of large digital computers now makes it possible to construct more realistic models with a reasonable expectation that numerical calculation of their motions will give a deeper insight into cavitation phenomena. In order to exploit this possibility, a mathematical formulation has been constructed in the form of a set of nonlinear ordinary differential and algebraic equations that can be solved simultaneously, and economically, on a digital computer. Two objectives of this program of computation have been to obtain numerical solutions of this formulation that give reliable estimates of physical quantities associated with bubbles in violent motion and to assess the effects of heat conduction, viscosity, sound radiation, and surface tension of such quantities. In this report, the formulation is derived and an assessment of the reliability of its predictions made. Author (TAB)

N66-26546*# Rocketdyne, Canoga Park, Calif.
THE DESIGN AND ANALYSIS OF SENSITIVITY EXPERIMENTS, VOLUME I AND VOLUME II
D. Rothman, M. J. Alexander, and J. M. Zimmerman May 1965 477 p refs
(Contract NAS8-11061)
(NASA-CR-62026, Vol. I; NASA-CR-62026, Vol. II) CFSTI: HC $7.77/MF $2.25 CSCL 20

Basic guidelines are outlined for the design and analysis of sensitivity experiments. To assist in the selection of an appropriate procedure for designing or analyzing a sensitivity experiment, a general review of the major classes of sensitivity experiments is provided. Included are discussions of the inverse response problem, programs for the discrimination between response functions, selection of a response function, estimation of the parameters in a response function, ranking response functions, testing for monotonicity of the response function, and safety and reliability evaluation programs. Discussions are also provided of those recently developed design and analysis procedures which appear to have merit for general applications, and those methods which have already found wide use in the field of stochastic processes. The difficulties of making proper assumptions about the type of response function being sampled and the effect of incorrect assumptions are treated, and attention is given to the development of several distribution-free design and analysis procedures which assume generally only that the response function is nondecreasing with increasing stimulus. Computer codes for solving the more difficult mathematical calculations are described and appended. H.S.W.

N66-26639*# Israel Program for Scientific Translations, Ltd., Jerusalem.
FINITE-DIMENSIONAL MODELS FOR EQUATIONS OF MATHEMATICAL PHYSICS
A. L. Krylov *In its* Numerical Methods in Gas Dyn. 1966 p 114–120 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

Finite dimensional models are constructed for systems having an exact law of energy conservation of the form which can be interpreted as the conservation of energy or entropy. It is pointed out that the equations can be extended in a natural manner to irreversible processes, in which case the formula given for the conservation law is regarded as the equation of energy dissipation. A Cauchy problem with periodic boundary condition for x is considered; other boundary conditions are treated analogously, including the case of a region unbounded in x with the relevant functions vanishing at infinity. Results indicate that finite dimensional models can apparently be used to obtain difference schemes having the same properties. M.G.J.

N66-26660*# Little (Arthur D.), Inc., Cambridge, Mass.
MEASURED DIRECTIONAL REFLECTANCES OF CHARS IN THE UV, VISIBLE, AND NEAR INFRARED

Mar. 1966 79 p ref Prepared for JPL
(Contracts NAS7-100; JPL-950867)
(NASA-CR-75128; C-66658) CFSTI: HC $3.00/MF $0.75
CSCL 20F

A technique was developed for measuring the reflectances of precharred carbonaceous ablators at room temperature at 2200°F, in a study to establish methods for predicting the materials' radiant heat absorption and reradiation under atmospheric entry conditions. The measurements were made on both fine and coarse grained samples at 0.2, 0.4, 0.65 and 1.0 microns, using a three-dimensional technique, for the angles 33°, 45°, 60°, and 72°. In all 75 measurements were performed: 55 on cold chars, 7 on hot chars, and 13 on other cold materials including pyrolytic graphite, Cat-a-lac black paint, and magnesium oxide. The reflectances for the cold chars ranged for 0.7 to 0.10, depending on angle and wavelength. The coarser grained chars (40–50 mesh) ran slightly lower in reflectance, 5 to 10%, than the finer grained chars (80–100 mesh). In general, it is pointed out, the char's directional spectral reflectances were relatively independent of angle and of wavelength; each exhibited variation on the order of 1/10 reflectance value over the angle and wavelength ranges. D.T.

N66-26711# Army Natick Labs., Mass.
STUDY OF DYNAMIC BIREFRINGENCE AND STRAIN PRODUCED IN TRANSPARENT POLYMERS BY MECHANICAL IMPACT Progress Report, Jan. 1964–Jun. 1965
Anthony F. Wilde, John J. Ricca, Francis deS. Lynch Feb. 1966 29 p refs *Its* Tech. Rept.-66-6-CM
(C&OM-18; AD-630913) CFSTI: HC $2.00/MF $0.50

To obtain basic information about the mechanical and optical response of polymers, the stress-wave propagation in transparent plastics is being studied by observation of the dynamic strain and birefringence produced by mechanical impact. In this initial study, the dynamic strain-fringe constant of CR-39 plastic was studied over a range of apparent strain rates between 2,300 and 30,600 percent strain per second by the simultaneous measurement of the strain and birefringence occurring during the nearly linear leading edge of the strain pulse. Over this dynamic range no distinct dependence on the strain rate could be discerned. However, comparison of the average dynamic strain-fringe constant with the corresponding static value indicated a slight rate dependence over this larger total range of apparent strain rates. Author (TAB)

N66-26716# Rutgers Univ., New Brunswick, N. J. Materials Research Lab.
A PRECISE DETERMINATION OF INTERPLANAR SPACING FROM DIVERGENT BEAM PHOTOGRAPHS First Technical Report, Sep. 1965–Apr. 1966
A. Shrier, Z. H. Kalman, and S. Weissmann Apr. 1966 9 p refs
(Contract DA-31-124-ARO(D)-414)
(AROD-5803-2; AD-631179) CFSTI: HC $1.00/MF $0.50

Precise lattice parameter determination by means of the divergent X-ray beam method is simplified by placing a wire grid between film and specimen, and employing a double-exposure technique. Shadows cast by the grid appear as breaks in the ellipses of the pattern. The film coordinates of these breaks are utilized to calculate the d-values of the reflecting planes. Author (TAB)

N66-26721# Little (Arthur D.), Inc., Cambridge, Mass.
TEMPERATURE DEPENDENCE OF THE INFRARED SPECTRA OF SELECTED DIELECTRICS Final Report, Jan. 1963–Jan. 1965
J. R. Jasperse, E. P. Marram, and O. M. Calrk 20 Jan. 1965 52 p refs *Its* Rept.-65318
(Contract AF 19(628)-2767)
(AFCRL-65-252; AD-624846) CFSTI: HC $3.00/MF $0.50

The infrared spectra was measured for LiF and MgO at temperatures ranging from 7.5°K up to near the melting point for each crystal. The data were curve-fitted to a two-pole, damped, harmonic oscillator model and a temperature dependent expression for the dielectric constant was determined. These expressions were compared in detail to existing quantum mechanical models for the dielectric susceptibility and reasonably good agreement between theory and experiment was observed. However, some deviations at low temperatures appear between experiment and the best quantum mechanical models available. Author (TAB)

N66-26789# Argonne National Lab., Ill.
STRESS ANALYSIS OF REINFORCED CIRCULAR AND RECTANGULAR FLAT PLATES
James L. S. Chen, Chia-shing Lai, and Donald A. Moen Aug. 1965 28 p refs
(Contract W-31-109-ENG-38)
(ANL-7089) CFSTI: HC $2.00/MF $0.50

A set of mathematical models is constructed for applying orthotropic plate theory to the case of plates with attached ribs or stiffeners. The procedure for obtaining an optimum design of plates is given for a desired deflection limitation. Two sets of computer programs, one for applying simple beam theory to the deflection of plates as an approach, and the other for orthotropic plate theory, are written in FORTRAN II language to determine the optimum cost. A numerical example is executed by an IBM-1620 computer. The results indicate that the two approaches are in reasonable agreement. Author (NSA)

N66-26816# Chemical Lab. RVO-TNO, Rijswijk (Netherlands).
ELECTROSTATIC ASPECTS OF AEROSOL FILTRATION. I: RESEARCH PROGRAM [ELECTROSTATISCHE ASPECTEN VAN DE AEROSOLFILTRATIE. I: PLAN VOOR HET ONDERZOEK]
R. J. H. Voorhoeve and L. A. Clarenburg Aug. 1965 15 p In DUTCH; ENGLISH summary *Its* Rept.-1965/11
(TDCK-43719) CFSTI: HC $1.00/MF $0.50

An outline is given of the electrostatic aspects of aerosol filtration. Three topics are considered for the study of these aspects: (a) the charge of the aerosol particles, (b) the charges on the filter fibers or other filter elements, and (c) the electrostatic interaction of the filter and the aerosol particles. Primarily, the project is confined to a fundamental study of the latter two subjects and to the development of aerosol filter elements based on electrostatic attraction. Author

N66-26829# General Dynamics/Convair, San Diego, Calif.
EMPIRICAL INFRARED ABSORPTION COEFFICIENTS OF H_2O FROM 300°K TO 3000°K
C. C. Ferriso, C. B. Ludwig, and A. L. Thomson Dec. 1965 62 p refs
(Contract Nonr-3902(00); Proj. Defender)
(GD/C-DBE-65-028; AD-625582) CFSTI: HC $3.00/MF $0.75

A set of absorption coefficients for water vapor as functions of temperature has been empirically deduced from existing quantitative absorption and emission spectra between 1 and 22 microns. The basic assumption was made that, for optically thick gases, the curve of growth is given by a statistical model. The absorption coefficients were obtained for each

vibration-rotation band by adjusting the band averaged line half widths and line spacings such that the integral of the absorption coefficients was equal to the known integrated intensity of the particular band at a given temperature. The effect of foreign gas broadening and non-resonant water molecule broadening was included. The present results are compared with independent theoretical and experimental results and the agreement is satisfactory. Author(TAB)

N66-26830# RAND Corp., Santa Monica, Calif.
NUMERICAL RESULTS FOR INTERNAL INTENSITIES IN ATMOSPHERES ILLUMINATED BY ISOTROPIC SOURCES
H. H. Kagiwada and R. E. Kalaba Apr. 1966 144 p
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4958-PR; AD-631015) CFSTI: HC $14.60/MF $1.00

The b and h functions are introduced as internal intensities of finite homogeneous slabs due to isotropic sources of energy at the top and the bottom of the slabs, respectively. The slabs absorb and isotropically scatter radiation. The b and h functions are of interest in themselves, and are also important in the determination of internal fields due either to parallel rays of incident radiation or arbitrary internal emitting sources. The b and h functions are computationally produced as solutions of stable initial value problems. The thickness of the slab is the independent variable, while the optical altitude above the bottom and the direction of propagation are fixed parameters. Extensive tables of these functions are presented for albedos of single scattering ranging from 0.1 to 1.0, for a range of optical thicknesses and depths, and for fifteen directions of propagation. The FORTRAN computer program which produced these tables is presented. Author (TAB)

N66-26883*# National Bureau of Standards, Washington, D.C.
[RADIOMETRIC STANDARDS FOR THE EXTREME ULTRAVIOLET] Quarterly Progress Report, 1 Jan.-31 Mar. 1966
R. P. Madden et al 10 May 1966 23 p refs
(NASA Order R-73)
(NASA-CR-75293) CFSTI: HC $1.00/MF $0.50 CSCL 20F

Measurements of radiation scattered from mirror surfaces have been made at the wavelengths 1216 Å and 584 Å. The method utilized a relatively small area detector which was scanned in angle about the sample substrate, and a subsequent integration over the scattering angle. Results have been obtained from several glass and fused silica substrates with different degrees of surface polish, and from evaporated films of aluminum and gold as a function of film thickness. The results indicate that fused silica can be polished to a smoother surface than can be achieved with glass, that a smooth substrate surface is significantly advantageous in obtaining evaporated films having surfaces with relatively little scatter, and that gold films are considerably smoother than aluminum films of equal thickness. Author

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N66-25388# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
THE ADAPTION OF 100-CHANNEL AMPLITUDE ANALYSER "RADUGA" MOD.AI-100-1 FOR TIME MEASUREMENT [ADAPTACJA 100 KANALOWEGO ANALIZATORA AMPLITUDY TYPU AI-100-1 "RADUGA" (DO POMIAROW CZASOWYCCH]
J. Lenartowicz and A. Turos Jun. 1965 17 p In POLISH; ENGLISH summary
(INR-638/I/PL) CFSTI: HC $1.00/MF $0.50

Investigations of nuclear reaction products with decay periods of 10^{-3}+10 sec require the use of multichannel time analyzers. The aim of this work was adaptation of the 100-channel pulse height analyzer "Raduga" for time measurements without distorting its ability to work as a pulse height analyser. The time channel width depends on the external time generator. The minimum time channel width, about 40μsec, depended on the rate of registration in the analyzers memory. Author

N66-25395# European Organization for Nuclear Research, Geneva (Switzerland).
THE QUALITY OF THE MEASUREMENTS OF THE FIRST BUBBLE CHAMBER EXPERIMENT PROCESSED WITH THE CERN HPD
P. Villemoes 4 Feb. 1966 105 p refs
(CERN-66-4)

In connection with the processing of the first bubble chamber experiment using the CERN HPD, a comparison of the results with those obtained from conventional IEP machines is made. The experiment comprises about 21,000 four-prong events produced by the interaction of 5.7 GeV/c antiprotons in the Saclay 81 cm liquid hydrogen bubble chamber, and about 900 of the events have been measured on both machines. The comparison is carried out on a track-by-track and an event-by-event basis using the direction angles and curvature for the tracks and the final identification for the events. The part of the comparison sample which is not accepted for physics is also examined for any bias with respect to the accepted part. The comparison shows that the HPD measurements are not inferior to the IEP results, and no bias is detected in the rejected part of the sample. Author

N66-25398# European Organization for Nuclear Research, Geneva (Switzerland). Nuclear Physics Div.
CHOICE OF SUBSTANCES FOR POLARIZED PROTON TARGETS
M. Borghini 31 Jan. 1966 36 p refs
(CERN-66-3)

The principle of dynamic polarization by solid effect is described, and the background problems due to heavy nuclei are discussed. It is pointed out that, in general, the solid effect necessitates that the spin–lattice relaxation of the hydrogens should come from their interaction with the electron spins which are used for their polarization, and that the polarization probability due to the microwave field should be much larger than the total relaxation probability from all possible sources. Listed among the measurements which should be considered in choosing appropriate compounds are: possible concentrations of electron spins, their line width and its origin; spin–spin and spin–lattice relaxation rates; the possible existence of phonon bottleneck; thermal conductivity of the sample; and proton relaxation mechanisms and their rates. Tabulated data are presented on several compounds, showing their density and the two quantities which represent the number of free protons (hydrogen) divided by the total number of protons, and by the total number of nucleons in each sample. Details on each substance are also included. M.G.J.

N66-25408# India. Dept. of Atomic Energy, Bombay.
S4B PROGRAM FOR SOLVING MULTI-GROUP TRANSPORT EQUATIONS WITH CARLSON'S S_4 APPROXIMATION
M. G. Bhide 1965 32 p refs
(AEET-210) CFSTI: HC $2.00/MF $0.50

S4B program can solve multi-group Boltzmann equations in Carlson's S4 approximation and it is a modified version of SNG code written for IBM-704 at Los Alamos by Carlson. It has additional options and special mathematical routines to accelerate its convergence making it 3 times faster than diffusion theory codes like RE-101 of ANL, U.S.A. It can handle critical and non-critical systems (with or without multiplication of neutrons by fission process) in infinite plane slab, infinite cylinder and sphere geometries. Finite slabs and cylinders can also be considered by correcting transport cross-sections with transverse bucklings varying with different regions and different energy groups. The second version (S4B II) has more options like reflective boundary condition on the outside (Useful for making reactor lattice calculations, etc.), and unsymmetric plane slab geometry. This code will help to derive many reactor parameters (e.g. lattice calculations) on a theoretical basis rather than on empirical basis which is a common practice at present. Author

N66-25419# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
ON THE $|\Delta I| = 1/2$ RULE IN KAON DECAYS
B. d'Espagnat and J. Iliopoulos Mar. 1966 10 p refs
(TH/139) CFSTI: HC $1.00/MF $0.50

A recent derivation of the $|\Delta I| = 1/2$ rule for the nonleptonic K-decay amplitudes is examined. Some doubts are raised concerning the applicability of the result to the physical situation. Author

N66-25429# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.
A DEVICE FOR THE FOCUSING AND MAGNETIC ANALYSIS OF CHARGED PIONS PHOTOPRODUCED BY THE FRASCATI ELECTROSYNCHROTRON. PART III: CONTROL OF THE OPTICAL PROPERTIES OF THE MAGNETS BY MEANS OF A HODOSCOPE WIRE [UN DISPOSITIVO PER LA FOCALIZZAZIONE E L'ANALISI MAGNETICA DI PIONI CARICHI FOTOPRODOTTI DALL'ELETTROSINCROTRONE DI FRASCATI. PARTE III: CONTROLLO DELLE PROPRIETA OTTICHE DEI MAGNETI MEDIANTE UN ODOSCOPIO A FILO]
G. Sanna 20 Dec. 1965 46 p refs In ITALIAN *Its* Nota Interna No. 300
(LNF-65/48) CFSTI: HC $2.00/MF $0.50

Experimental results obtained from a hodoscope model equipped with quadrupole lens and electromagnets are reported graphically. The accuracy of focal and dispersion measurements made by the lens, and the optical properties of the magnets are evaluated. A direct projection is made by the hodoscope of the trajectories of charged particles. Physical properties of the hodoscope conducting wire, and the radiation emitted by the particles are analyzed. Transl. by R.Ll.

N66-25430# India. Dept. of Atomic Energy, Bombay. Nuclear Physics Div.
EMISSION OF LONG RANGE ALPHA PARTICLES IN FISSION
T. Methasiri 1965 44 p refs
(AEET-235) CFSTI: HC $2.00/MF $0.50

This paper presents a survey of the experiments and the various theories that have been put forth to explain the phenomenon of long range alpha particle emission in fission. Experimental work on the relative probability of binary to ternary fission, energy spectrum of long range alpha particles, kinetic energy distribution of fission fragments in ternary fission, emission of other charged particles, angular correlation of alpha particles, and mass distribution of fission fragments in ternary fission is reviewed. Some of the theories which describe the alpha particle emission in fission are discussed and include the liquid drop model, the two step process hypothesis, the snapping process, and the evaporation process. The survey shows that there is still much controversy in explaining the emission of alpha particles, however, the evaporation model explains most of the facts without invoking any new nuclear process. R.N.A.

N66-25440# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Reaktorzentrum.
NUCLEAR PHYSICS WORK AT REAKTORZENTRUM SEIBERSDORF [KERNPHYSIKALISCHE ARBEITEN IM REAKTORZENTRUM SEIBERSDORF]
P. Weinzierl [1961] 56 p refs In GERMAN
(SGAE-PH-34/1965) CFSTI: HC $3.00/MF $0.50

Concept of the work was optimum use of the installation's 5-mW Astra reactor for nuclear spectroscopy. Progress in the following projects is briefly listed: (1) design of an electromagnetic mass separator for isotopes in beta sources produced by (n,γ)-reactions; (2) separation of rare earths in oxide form; (3) separation of stable inert gas isotopes and production of accelerator targets; (4) measuring of neutron collector sections; (5) evaluation of continual beta spectrums; (6) two methods for measuring neutron disintegration; (7) a facility for measuring high-energetic spectrums; and (8) life duration of (n,γ)-reaction in manganese, dysprosium, and erbium. Investigation of spontaneous γ-scattering during nuclear fission was started. Transl. by K.W.

N66-25449# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
PHOTODISINTEGRATION OF THE DEUTERON BY POLARIZED γ RAYS
G. Barbiellini, C. Bernardini, F. Felicetti, and G. P. Murtas 4 Feb. 1966 16 p refs *Its* Internal Note 305
(LNF-66/4) CFSTI: HC $1.00/MF $0.50

A curve for the asymmetry function $\Sigma(\theta,x)$ at $\theta = 90°$ (c.m. proton angle) as a function of photon energy was obtained from measurements of the photodisintegration of a deuteron using an experimental apparatus which is schematically depicted. The apparatus consists of a proton range telescope (with scintillation counters), a multiplate spark chamber, and a neutron counter. Detailed characteristics of the apparatus are given, and a block diagram of the electronic circuitry is shown. The principle of operation is based on the photodisintegration of the deuteron by polarized gamma rays. An expression for computing the statistical error on Σ is given. The asymmetry function curve is compared to curves obtained from other total photodisintegration cross section data, and the present curve (obtained from calculations according to the Wilson mixture) shows very good qualitative agreement. L.S.

N66-25450# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
PASSAGE OF NEUTRONS OF ENERGY $E_o \leq 30$ MeV IN ORDINARY CEMENT AND IN ITS COMPONENTS [PASSAGGIO DI NEUTRONI DI ENERGIA $E_o \leq 30$ MeV IN CEMENTO ORDINARIO E NEI SUOI COMPONENTI]

M. A. Locci, P. Picchi, and G. Verri 16 Feb. 1966 27 p refs In ITALIAN
(LNF-66/7) CFSTI: HC $2.00/MF $0.50

Some of the single elements of cement (H, C, O, Na, Mg, Al, Si, K, Ca, Fe) were studied as neutron absorbers, and the calculation was programed in Fortran IV language. Information was obtained on the n+A process since the program simulates tridimensionally all the physical details of neutrons, such as the angular distribution of neutrons scattered elastically, and the state of neutrons in a thermal zone at capture. Inconclusive data were found for C and O due to the low value of the incident neutrons at the time of microscopic collision in the thermal zone. Transl. by R.Ll.

N66-25451# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
A PROPOSAL FOR THE ADMINISTRATION OF RADIATIVE CORRECTIONS
Etim Etim and B. Touschek 2 Mar. 1966 15 p refs *Its* Internal Note 310
(LNF-66/10) CFSTI: HC $1.00/MF $0.50

This paper presents a proposal for the rational division of work between the experimenter and the theorist in the administration of radiative corrections. It is shown that with an accuracy sufficient to deal with experiments in which the statistical error will be smaller than 5%, it is possible to compare two experiments either directly with one another or with the theoretical predictions based on the calculation of an idealized standard experiment. The direct comparison of two experiments only involves the classical features of electrodynamics and the methods of statistical mechanics can be applied. R.N.A.

N66-25452# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
PRELIMINARY STUDY OF AN ELASTIC SCATTERING EXPERIMENT TO BE PERFORMED AT ADONE [STUDIO PRELIMINARE DI UNA ESPERIENZA DI DIFFUSIONE ELASTICA DA EFFETUARSI AD ADONE]
U. Amaldi, Jr., R. Biancastelli, and P. Stein 14 Feb. 1966 27 p refs
(ISS-66/2) CFSTI: HC $2.00/MF $0.50

On the same line of a recently performed statistical analysis of electrodynamical experiments and as a first step towards a definite proposal, varius possible ways of studying the reaction $e^+ + e^- \rightarrow e^+ + e^-$ are discussed. Experiments both without and with magnetic field are considered and the information obtained distinguishing the charges without momentum measurement are analyzed. Author

N66-25455# United Kingdom Atomic Energy Authority, Harwell (England). Theoretical Physics Div.
TEST FOR T-INVARIANCE IN N-N SCATTERING
R. J. N. Phillips Jan. 1966 19 p refs
(AERE-R-5138) HMSO: 2s 6d

Expressions are given for the polarization tensors of nucleon-nucleon scattering, assuming time-reversal (T) invariance does not hold. Some pairs of tensors, apparently related by T, prove to be equal regardless of T-invariance; others offer genuine tests of T-invariance. Author

N66-25456# United Kingdom Atomic Energy Authority, Harwell (England). Theoretical Physics Div.
TIME-DEPENDENT HARTREE-FOCK THEORY AND NUCLEAR VIBRATIONAL MODELS
D. J. Rowe Jan. 1966 53 p refs
(TP-209)

In a previous paper a quantum mechanical interpretation of time-dependent Hartree-Fock (TDHF) theory was developed, which demonstrated its equivalence to random phase approximation (RPA), but which was much more physical. Here this approach is pursued to derive a quantum mechanical version of the Vibrating Potential Model (VPM). It is derived explicitly as an approximate and simplified version of the TDHF method, and such that the approximations are clearly defined. The model is then used to derive and to exhibit the approximations implied in a number of other vibrational models. It thus appears as the vital link in the chain which relates the phonomenological collective models to the RPA, and gives a unified theory of nuclear vibrations. Author

N66-25467# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
GAS FORMATION BY TRANSMUTATION OF MgO AND Al_2O_3
R. S. Wilks Feb. 1966 12 p refs
(AERE-R-5143)

The concentration of gas produced by the transmutation of magnesium, aluminum, and oxygen isotopes is so small that consideration must be given to gas formation due to transmutation of impurities. Gas atoms are produced by the following reactions that occur with thermal neutrons: $B^{10}+n \rightarrow Li^7+He^4$ and $Li^6+n \rightarrow H^3+He^4$. The discrepancy between the experimentally determined concentration of He^4 (2.2 ± 0.2) and that calculated in this research (0.6) could be explained by one ppm of boron or 8 ppm of lithium in the MgO; the impurity content of the MgO is not known. It is concluded that the Mg^{25} (n,α) Ne^{22} reaction does not occur with thermal neutrons, and the present calculations are reasonably consistent with the previous experimental data. M.W.R.

N66-25482# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
CURRENT ALGEBRAS AND ANNIHILATIONS INTO MESONS
J.-L. Gervais, J. Iliopoulos, and J. M. Kaplan (Inst. des Hautes Etudes Sci.) Mar. 1966 15 p refs
(TH/136) CFSTI: HC $1.00/MF $0.50

Using current algebras in the low energy limits, we derive relations between electron-positron annihilations into two pseudoscalar mesons and meson-meson scattering. We also obtain some relations for proton-antiproton annihilations at rest. Author

N66-25490# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
OPTICAL MODEL AMBIGUITIES FOR THE Λ-^{59}CO INTERACTION [NIEJEDNOZNACZNOSCI MODELU OPTYCZNEGO DLA ODDZIALYWANIA Λ-^{59}CO]
A. Budzanowski, A. Dudek, K. Grotowski, J. Kuzminski, H. Niewodniczanski et al Jan. 1966 18 p refs Submitted for Publication
(Rept.-440/PL) CFSTI: HC $1.00/MF $0.50

The problem of the optical model ambiguities for the interaction of alpha particles with Co^{59} nuclei has been investigated. A complete search was performed in the region of the real part of the potential from 0 to 200 MeV and for the imaginary part of the potential from 0 to 20 MeV. The best agreement with the experimental data was found for the potential with the real part in the vicinity of 100 MeV. Author

N66-25493# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
SUM RULES FROM THE ALGEBRA OF CURRENT DENSITIES
C. Bouchiat and Ph. Meyer Mar. 1966 29 p refs
(TH/143) CFSTI: HC $2.00/MF $0.50

A general method to derive sum rules involving mass shell amplitudes from the algebra of space and time components of the current densities is developed. It is shown that the so-called Schwinger terms can be eliminated in the quark model by a proper symmetrization. The case of vector currents is discussed for the spin 1/2 baryons and in particular the sum rules associated with the equal time commutation relations of the magnetic moments. Author

N66-25501# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.
A LIQUID He^3 TARGET FOR HIGH ENERGY NUCLEAR EXPERIMENTS
I. Modena, V. Montelatici, and F. Scaramuzzi 21 Jan. 1966 12 p refs *Its* Nota Interna No. 302
(LNF-66/1) CFSTI: HC $1.00/MF $0.50

A liquid He^3 target has been constructed for experiments on He^3 photodisintegration using the gamma beam of the Frascati 1.1 BeV electron synchrotron. The cryostat, developed from a standard hydrogen/deuterium target, and the nickel cell which holds the He^3 target are described along with schematic drawings. Also included are a schematic drawing of the flow circuit and the results of vacuum tests performed on the cryostat. R.N.A.

N66-25597# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
INELASTIC SCATTERING OF ALPHA PARTICLES ON ATOMIC NUCLEI [NIESPREZYSTE ROZPRASZANIE CZASTEK ALFA NA JADRACH ATOMOWYCH]
Andrzej Budzanowski 1965 139 p refs In POLISH; ENGLISH summary
(Rept.-441/PL) CFSTI: HC $4.00/MF $1.00

Problems concerning inelastic scattering of alpha particles on 1d2s shell nuclei are discussed. The experimental angular distributions of the differential cross-sections for the inelastic scattering of 25 MeV alpha particles are compared with the predictions of a simple diffraction theory and with a more advanced distorted wave Born approximation. From these comparisons the values of spin, parity and the deformation parameter of some excited levels of ^{40}Ca, ^{39}K, ^{32}S, ^{31}P nuclides were obtained. The manner of comparing the deformation parameters obtained by the above-mentioned methods with the electromagnetic values of these parameters is shown. Author

N66-25648# Aktiebolaget Atomenergi, Stockholm (Sweden).
INTEGRAL PARAMETERS OF THE THERMAL NEUTRON SCATTERING LAW
S. N. Purohit 1964 52 p refs
(AE-154) CFSTI: HC $3.00/MF $0.50

Integral parameters of the thermal neutron scattering law—the thermalization binding parameter (M_2), the Placzek's moments of the generalized frequency spectrum of dynamical modes and the energy transfer moments of the scattering law—are theoretically discussed. A detailed study of the variation of M_2, the thermalization time constant and the effective temperature of the vibrating atoms, with the relative weight between intra-molecular vibrations and hindered rotations for H_2O, is presented. Theoretical results for different scattering models of H_2O are compared with the measurements of integral experiments. A set of integral parameters for D_2O, using Butler's model, have been obtained. Importance of the structure of hindered rotations of H_2O and D_2O in the study of integral parameters has also been discussed. Author

N66-25652# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
THE G-FACTOR OF THE 87 KEV EXCITED STATE IN ^{155}Gd
A. Z. Hrynkiewicz, S. Ogaza, J. Styczen, B. Hrastnik, B. Pudlowska et al Nov. 1965 25 p refs Submitted for Publication
(Rept.-430/PL)

The g-factor of the 87 keV state in Gd 155 was measured by the observation of the perturbation of angular correlation in the external magnetic field in melted metallic sources, using both integral and differential techniques. The results are in good agreement with the value obtained indirectly from the magnetic hfs-coupling in a liquid source. The structure of the 87 keV level is discussed on the basis of the average value $g=0.376\pm0.026$. Author

N66-25661# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria).
A NEW METHOD FOR LOW-LEVEL SCINTILLATION COUNTING
R. Patzelt and H. Halling Jan. 1966 14 p Submitted for Publication
(SGAE-E-6/1966) CFSTI: HC $1.00/MF $0.50

It is stated that since low energy beta rays cause weak scintillations and release few electrons from the cathode of a photomultiplier, they can only be distinguished from noise pulses if two or more electrons are released. A method which makes possible pulse-shape discrimination between noise and scintillation pulses is suggested. If two or more electrons occur at the photocathode, it was assumed that they were released at different points. It was then postulated that the transit-time-difference from different regions of the cathode to the first dynode could be increased, without affecting the collection efficiency or the width of the single-electron pulses. A pulse would then be produced which could be recognized by a pulse-shaped discriminator. The artificial increase of the transit-time between the photocathode and the first dynode can be realized by adjusting the voltages of the focussing electrode and the first dynode or by using a photomultiplier with a flat or convex photocathode. Some calculations are given for estimating the resolution time, the transit-time-differences that are necessary, and the efficiency that can be expected. The bases for these calculations are also defined. H.S.W.

N66-25668# General Dynamics Corp., San Diego, Calif. General Atomics Div.
EXPERIMENTAL STUDIES ON HEAVY ION EXCHANGE IN AIR Annual Summary Report, 24 Aug. 1964-24 Sep. 1965
W. L. Fite, J. K. Layton, R. F. Stebbins Kirtland AFB, N. Mex. AF Weapons Lab., Feb. 1966 70 p refs
(Contract AF 29(601)-6614)
(GA-6738; AFWL-TR-65-181; AD-630137) CFSTI: HC $6.60/MF $0.75

Charge-changing collisions between Al, Fe, and U, and the gases Ar, N_2, O_2, and air have been examined over the velocity range 0.25 to 3.7×10^8 cm sec^{-1}. Fast particle detection was used to obtain values for the electron-capture cross

section σ_{10}, the ion-stripping cross sections σ_{12}, σ_{13}, and σ_{14}, and the neutral atom-stripping cross section σ_{01}. σ_{01} was also investigated in the lower velocity range (0.1 to 0.6×10^8 cm sec^{-1}) for K, Te, and Ag. These σ_{01} cross sections are roughly the same for all metal atoms with the exception of U, which was larger. σ_{10} is in all cases almost an order of magnitude smaller than σ_{01}. Sources for the production of metallic ions are discussed together with general considerations pertaining to experiments using such ions.

Author (TAB)

N66-25769# Rochester Univ., N. Y. Dept. of Physics and Astronomy.

STUDIES OF THE $^{12}C(^3He, ^3He)^{12}C$ AND $^{12}C(^3He,\alpha_0)^{11}C$ REACTION

J. J. Schwartz, W. Parker Alford, L. M. Blau, and D. Cline 29 Apr. 1966 32 p refs Submitted for Publication

(Contract AT(30-1)-875)

(UR-875-141)

Angular distributions of emergent ^3He and ^4He particles from the $^{12}C(^3He,^3He)^{12}C$ and $^{12}C(^3He,\alpha_0)^{11}C$ reactions have been measured at several energies from 8.5 to 10.0 MeV. Excitation functions for these reactions have been measured at laboratory angles of 15°, 45°, and 75°. Distorted wave calculations have been performed, with the optical model parameters for the entrance channel being obtained from the elastic scattering results, and those for the exit channel being varied to obtain the best fit. The calculations provide satisfactory fits to the observed shape of the elastic and reaction angular distributions. The magnitude of the cross section is substantially greater than predictions, however. Author

N66-25790# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

A STATISTICAL ANALYSIS OF THE LIMIT ON THE BREAKDOWN OF QUANTUM ELECTRODYNAMICS ATTAINABLE WITH ELECTRON–POSITRON COLLIDING BEAM MACHINES [STUDIO STATISTICO DEI LIMITI CHE POSSONO ESSERE POSTI DA ESPERIENZE INIZIATE DA FASCI COLLIDENTI DI ELETTRONI E POSITONI SULLA VALIDITA DELLA ELETTRODINAMICA QUANTICA]

U. Amaldi, Jr., R. Biancastelli, and P. Stein 15 Jan. 1966 36 p refs

(ISS-66/1) CFSTI: HC $2.00/MF $0.50

In the hypothesis that there is no breakdown of quantum electrodynamics, the upper limits which can be put on a simple breakdown parameter performing $e^+ + e^- \rightarrow e^+ + e^-$, $e^+ + e^- \rightarrow \gamma + \gamma$ and $e^+ + e^- \rightarrow \mu^+ \mu^-$ experiments at different energies with a "reasonable" apparatus are obtained. While the discussion of the $\mu^+ \mu^-$ experiment is simple, the first two reactions, whose angular distribution is sensitive to the breakdown, are studied simulating experiments on the IBM 7040 computer and then analysing them by means of the maximum likelihood method. The effects of experimental inefficiencies and of errors introduced in correcting the data for radiative processes are considered. Author

N66-25795# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

ON THE RESIDUAL NUCLEI OBSERVED IN THE INTERACTIONS OF 25 GeV/c PROTONS WITH HEAVY EMULSION NUCLEI

Ewa Makowska, Jolanta Sieminska, Marta Soltan, Steve St. Lorant (CERN), and Joanna Suchorzewska Jul. 1965 23 p refs

(Rept.-631/VI/PH) CFSTI: HC $1.00/MF $0.50

The kinematical analysis of the residual nuclei in the interaction of 25 GeV/c protons with heavy nuclei in low sensitive emulsion has been made for a sample of 354 stars containing Li^8 fragment. The average velocity component in the directions of the beam is $\beta_x=(0.004\pm0.002)$ c for recoils and $\beta_x=(0.015\pm0.003)$ c for Li^8 fragments. The average mass number of residual nuclei was found to be equal about 30. In 30% of all the stars the masses of residual nuclei were comparable with that of other fragments. A correlation of the directions of the residual nucleus and the Li^8 fragment emission has been found. Author

N66-25800# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

A PROPOSAL FOR THE INVESTIGATION OF THE ϕ RESONANCE USING ADONE [PROPOSTA DI UNA ESPERIENZA DA EFFECTUARSI AD ADONE PER LO STUDIO DELLA RISONANZA ϕ]

U. Amaldi, Jr., A. De Gasperis, and P. Stein 23 Dec. 1965 41 p refs

(ISS-65/48) CFSTI: HC $2.00/MF $0.50

A proposal is made for studying the production of the vector meson ϕ observed through its K^+K^- decay using Adone, the electron-positron Italian colliding beam machine. The purpose of this relatively simple and short experiment is to study together with the cross section for the ϕ production and its energy dependence also the vacuum polarization effect due to the ϕ on the reaction $e^+ + e^- \rightarrow \mu^+ + \mu^-$. Moreover useful information on the machine itself will be obtained. Author

N66-25820# Portugal. Nuclear Energy Commission, Secavem. Laboratorio de Fisica e Engenharia Nucleares.

INTERPRETATION OF THE SPECTRE EPR OF THE ORTHODIMESITOILBENZENE BY THE METHOD OF MOLECULAR ORBITALS [INTERPRETACAO DO ESPECTRO RPE DO O-DIMESITOILBENZENO PELO METODO DAS ORBITAIS MOLECULARES]

A. F. Neiva Correia and J. Dos Santos Veiga 1964 11 p refs Repr. from Rev. Port. Quim., v. 6, 1964 p 67–71 In PORTUGUESE; ENGLISH summary

(LFEN-36 (γ)) CFSTI: HC $1.00/MF $0.50

The theoretical interpretation of the electronic paramagnetic resonance (e.p.r.) spectra of the orthodimesitoilbenzene cetyls is effected by the simple method of molecular orbitals. The theoretical π spin densities of the unpaired electron in the phenylene ring and the experimental values of the hyperfine splitting constants for the protons of that ring are compared by the McConnell formula. The Coulomb and resonance parameters introduced in the calculations are physically acceptable and agree with the previous values used in the interpretation of e.p.r. spectra. Author

N66-25833# Stanford Univ., Calif.

THRESHOLD EFFECTS IN NUCLEAR REACTIONS Final Report, Nov. 1, 1962–Jan. 31, 1966

Walter E. Meyerhof [1966] 9 p refs

(Grant DA-ARO(D)-31-124-G337)

(AROD-3269-27; AD-630042) CFSTI: HC $1.00/MF $0.50

The main lines of research, which are described briefly are as follows: Threshold effects in nuclear reactions, nuclear capture reactions, polarization effects in nuclear reactions, role of isotopic spin in nuclear interactions, and properties of excited states in light nuclei (energy, spin and parity, isotopic spin, lifetime). TAB

N66-25809# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ON A RECENT PAPER OF GAY
Norman W. Bazley (Battelle Mem. Inst., Geneva) and David W. Fox Oct. 1965 10 p refs
(Contracts NOw-62-0604-c; AFOAR AS-5-298)
(TG-743; AD-630035) CFSTI: HC $1.10/MF $0.50

A method is discussed for solving intermediate differential spectral theory problems of the following sort: A self-adjoint Hamiltonian H is assumed to be decomposable as $H=H^0+V$ in which V is positive definite, and H^0 is a resolvable self-adjoint Hamiltonian, i.e., H^0 has known eigenvalues indexed in increasing order and the corresponding eigenfunctions. The method, which was originally used to calculate ground states for helium-like atoms, is extended to the calculation of excited states and more complex systems. D.T.

N66-25942# Illinois Univ., Urbana.
(P,N) REACTION ON Zr^{91} FOLLOWED BY PROTON EMISSION
A. I. Yavin, R. A. Hoffswell, and T. M. Noweir [1966] 13 p refs Sponsored in part by ONR
(AD-630032) CFSTI: HC $1.60/MF $0.50

The reaction Zr^{91} (p,n) Nb^{91}, where Nb^{91} denotes the isobaric analogue of the ground state of Zr^{91}, was investigated by observing the proton decay of Nb^{91}. Proton spectra corresponding to 13.0, 13.15, and 13.3 MeV incident proton energies were recorded. The three spectra were then added in order to accentuate any proton group with energy largely independent of the incident proton energy. This procedure broadened extensively all proton peaks with the exception of one. It is strongly suggested that this peak results from the proton decay of Nb^{91} to the ground state of Zr^{90}. The observed energy release in this decay was 4.70±0.10 MeV. The Coulomb displacement energy is therefore 11.90±0.10 MeV. The observed integrated cross section for the Zr^{91} (p,n) Nb^{91} reaction, assuming isotropic decay for Nb^{91}, was approximately 5 mb. As expected, no such effect was observed when Zr^{90} was used as a target. Author (TAB)

N66-25967# Aktiebolaget Atomenergi, Stockholm (Sweden).
A STUDY OF THE "384" KeV COMPLEX GAMMA EMISSION FROM PLUTONIUM-239
R. S. Forsyth and N. Ronqvist Nov. 1965 15 p refs
(AE-202)

Gamma spectrometric studies of plutonium samples of several isotopic compositions were described using a sodium iodide detector and a lithium-drifted germanium detector. The 384-kev peak was shown to be a complex peak containing 12 gamma components due to plutonium-239 between 300 and 450 kev, and their relative intensities were estimated. Anion exchange and solvent extraction experiments also demonstrated that two further contributions due to uranium-237 are present in plutonium containing significant amounts of plutonium-241. Author (NSA)

N66-25970# Tokyo Univ. (Japan). Inst. for Nuclear Study.
SHELL EFFECTS IN THE COULOMB DISPLACEMENT ENERGIES OF THE EXCITED STATES
Hiroyasu Ejiri 29 Nov. 1965 18 p refs
(INSU-91)

The Coulomb displacement energies of the ground states and the excited states in light nuclei are obtained from the energy differences between the corresponding isobaric levels. The equivalent uniform radii of T=1/2 and T=1 levels are extracted from the Coulomb displacement energy. The shell effects are indicated in the equivalent uniform radii of the excited states and the ground states. Each state is found to have the equivalent uniform radius which is characteristic of the shell orbit. The levels in the same shell orbit have nearly the same equivalent radii, while the excitations to another shell orbit give rise to a discrete change of the equivalent uniform radii. The rotational states have the equivalent uniform radii close to that of the intrinsic state. These features are consistent with the simple shell model picture. Author (NSA)

N66-25972# Illinois Univ., Urbana.
$K_2^0 \rightarrow \pi^- + \pi^+$—A STRANGE DECAY FROM A STRANGE PARTICLE [$K_2^0 \rightarrow \pi^- + \pi^+$—EEN VREEMD VERVAL VAN EEN VREEMD DEELTJE]
B. M. K. Nefkens [1964] 19 p refs In DUTCH
(Contract AT(11-1)-1195)
(COO-1195-27) CFFSTI: HC $1.00/MF $0.50

Two experiments in which the decay $K_2^0 \rightarrow \pi^- + \pi^+$ was observed are summarized, and the various theories of this decay mode are discussed. NSA

N66-25973# Maryland Univ., College Park. Dept. of Physics and Astronomy.
K^-p INTERACTIONS FROM 900 TO 1100 MeV/c AND THEIR BEARING ON Y^* (1765) AND Y_0^* (1815)
G. B. Yodh Oct. 1965 36 p refs Presented at the Elementary Particles Conf., Colorado Univ., Boulder, 1965
(Contract AT(40-1)-2504)
(CONF-650837-3) CFSTI: HC $2.00/MF $0.50

A summary is presented of experimental data on K^-p interactions from 900 to 1100 MeV/c K^- momentum (total cms energy of the K^-p system from 1740 to 1840 MeV). The bearing of these results on the K^-p resonances Y_1^* (1765) and Y_0^* (1815) is discussed. Previous data are reviewed. Results of the neutral V channels and the Σ channels from bubble chamber experiments are discussed. Results on the energy, width, decay channels, spin-parity, and isospin of the resonances are summarized. NSA

N66-25975# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
FISSION OF RHENIUM AT INTERMEDIATE EXCITATION ENERGY
Clarence Menninga (Ph.D. Thesis) Jan. 1966 155 p refs
(Contract AT(11-1)-347)
(COO-347-19) CFSTI: HC $5.00/MF $1.00

The fission resulting from bombardment of naturally occurring ^{185}Re and ^{187}Re with 40.9-Mev ^4He ions was studied radiochemically. The target materials were extensively purified before irradiation. Thin targets were prepared by electroplating rhenium metal onto silver foil, and absolute cross sections were determined for the production of six selected nuclides. Relative cross sections were determined for six additional nuclides in bombardments of thick rhenium targets. The fission products were purified, and the activities were measured using low-background beta counters. Decay curves were resolved by a least square fit using an IBM 7094 computer. Determinations were made of several impurities remaining in the target material, and appropriate corrections were applied to the data. The mass distribution was observed to be symmetric. The full width at half maximum of the mass yield curve was 23±2 mass units. The average number of neutrons emitted per fission event was 1±1 neutrons. The total fission cross section was found to be 2.4± 0.6 microbarns. Author (NSA)

N66-25881# Purdue Univ., Lafayette, Ind.
MASS AND CHARGE DISTRIBUTION STUDIES IN THE FISSION OF Au^{197} BY INTERMEDIATE ENERGY HELIUM IONS
Frederick L. Lisman (Ph.D. Thesis) Jun. 1965 277 p refs
(Contract AT(11-1)-347)
(COO-347-17) CFSTI: HC $6.00/MF $1.50

The fission of ^{197}Au was studied radiochemically by bombarding thin targets of high-purity gold with 33.5-, 37.0-, and 50.0-Mev helium ions. The fission products were chemically separated and purified, and their activities were counted in low-level beta counters. The absolute fission cross sections, mass distributions, and charge distributions were determined.
Author (NSA)

N66-25888# Argonne National Lab., Ill.
THE ARGONNE-REVISED THERMOS CODE
B. J. Toppel and I. Bakays Mar. 1965 112 p refs
(Contract W-31-109-ENG-38)
(ANL-7023) CFSTI: HC $4.00/MF $0.75

The THERMOS code computes the scalar thermal-neutron spectrum as a function of position in a lattice by solving the integral transport equation with isotropic scattering. One-dimensional slab or cylindrical geometry can be used. The revised codes described are written entirely in 3600 FORTRAN for the CDC-3600 computer. NSA

N66-25890# General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation.
A NEUTRON CROSS SECTION LIBRARY FOR MONTE CARLO CODES FMC-N, 18-0 AND 18-1
L. S. Burns 23 Aug. 1965 114 p refs
(Contract AT(40-1)-2847)
(GEMP-384) CFSTI: HC $4.00/MF $0.75

Neutron cross sections for a number of materials were prepared in a format acceptable to GE-NMPO Monte Carlo Programs FMC-N, 18-0, and 18-1. Cross sections are presented for H, Be, B-10, C, O, Al, Cr, Fe, Ni, Nb, Mo, Te, W, U-235, and U-238. A brief summary of the processing procedure and the sources of the data are also included.
Author (NSA)

N66-25893# Princeton Univ., N. J. Plasma Physics Lab.
RADIATION FROM PLASMAS
John M. Dawson Dec. 1965 71 p refs
(Contract AT(30-1)-1238)
(MATT-428) CFSTI: HC $3.00/MF $0.75

Only the processes which give rise to bremsstrahlung (charged particle encounters) and to cyclotron and synchrotron radiation from plasmas were considered. A discussion is presented on black body radiation, its density inside a plasma, and absorption and emission coefficients in terms of collision times. NSA

N66-25996# Argonne National Lab., Ill.
COMPILATION OF REQUESTS FOR NUCLEAR CROSS SECTION MEASUREMENTS
A. B. Smith, comp. Aug. 1965 106 p
(Contract W-7405-ENG-38)
(WASH-1057; EANDC(US)-73(U)) CFSTI: HC $3.00/MF $0.75

Personal requests for particular cross section data are listed. The requests seek data on elastic scattering, nonelastic scattering, fast total and capture, thermal, resonance parameters, and fissile and neighboring nuclei. NSA

N66-26008# International Centre for Theoretical Physics, Trieste (Italy).
THE SU(6,C) SYMMETRY Lecture Notes
R. White Dec. 1965 24 p refs
(IC/65/84)

The method of creation and destruction of operators as proposed by Feynman and Gell-Mann is used to construct the ladder representation of SU(6,c), a group proposed as being the most economical noncompact extension of SU(6), and most extensively developed. The representations are constructed with simple decompositions according to the maximal compact subgroup, SU(6). These representations correspond to highly degenerate representations of the discrete series. NSA

N66-26009# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
PION PRODUCTION IN (N–P) COLLISIONS AT 600 MEV [OBRAZOVANIE Π-MEZONOV V (N-P)-STOLKNOVENIYAKH PRI ENERGII 600 MEV]
Yu. M. Kazarinov nd Yu. N. Simonov 24 Nov. 1965 18 p refs
(JINR-P-2462)

Angular distributions of charged pions and total production cross sections of neutral pions generated in n-p collisions at 600±10 Mev were measured. It was found that $\sigma_{\pi^\pm}(\theta)=[0.115\pm0.006)\pm(0.004\pm0.013)\cos^2\theta+(0.04\pm0.02)\cos^2\theta]\times(1.073\pm0.104)\times10^{-27}$ cm^2/sterad, in the cms of the colliding nucleons. The total cross sections of the reactions are $\sigma(np\to\pi^0)=(4.6\pm0.6)\times10^{-27}$ cm^2 and $\sigma(np\to\pi^+)=\sigma(np\to\pi^-)=(1.68\pm0.17)\times10^{-27}$ cm^2. The obtained data do not contradict the hypothesis of charge independence of nuclear forces. The cross sections for pion production in collisions of two nucleons in states with total isotopic spin T=0 and T=1 are equal to $(4.4\pm0.6)\times10^{-27}$ and $(10.85\pm0.42)\times10^{-27}$ cm^2, respectively. Author (NSA)

N66-26010# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON DETERMINATION OF THE SPIN AND PARITY OF THE Ω^--HYPERON [OB OPREDELENII SPINA I CHETNOSTI Ω^--GIPERONA]
S. M. Bilen'kii and R. M. Ryndin 23 Nov. 1965 10 p refs
(JINR-P-2458)

It is shown that spin and parity of the Ω^--hyperon can be uniquely determined by studying the nonleptonic decays of Ω^--hyperons produced in the reaction $K^-p\to\Omega^-+M_1$ (M_1 is a newly discovered boson with strangeness s=2) on a polarized target. The consideration is based on invariance principles only. No assumptions are made on the dynamics.
Author (NSA)

N66-26011# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
ANALYSIS OF REACTIONS $\pi N\to\Pi_1\Pi_2 N'$ [ANALIZ REAKTSII $\pi N\to\Pi_1\Pi_2 N'$ V OBLASTI ENERGII DO I GEV]
V. A. Zhukov, L. L. NNemenov, and Rung-Fang Yuang 1965 14 p refs In RUSSIAN
(JINR-P-2454)

The cross sections for the $\pi N\to\pi+N^*_{3/2}$ processes are determined in the energy range 290–905 MeV. Author (NSA)

N66-26014# Akademiya Nauk SSSR, Novosibirsk. Institut Yadernoi Fiziki.
GRAVITATION AND FINITE RENORMALIZATION IN QUANTUM ELECTRODYNAMICS [GRAVITATSIYA I KONECHNYE PERENORMIROVKI V KVANTOVOI ELEKTRODINAMIKE]

I. B. Khriplovich 1965 19 p refs In RUSSIAN; ENGLISH summary
(NP-15762)

Electromagnetic self-energy and wave function renormalization constant of the electron become finite when taking into consideration some model of its gravitational interaction. In the first order in e^2 the self-energy totals 20% of the physical mass. The semiclassical calculation of the electrostatic energy of the Dirac electron when taking into account the space curvature leads to nearly the same result. Author (NSA)

N66-26015# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
RADIATIVE CORRECTIONS FOR E-P SCATTERING FOR ANGULAR AND ENERGY COINCIDENCE EXPERIMENTS [STRAHLUNGSKORREKTUREN ZUR E-P STREUUNG FUR WINKEL- UND ENERGIEKO-INZIDENZ-EXPERIMENTE]
R. D. Kohaupt (Hamburg Univ.) Oct. 1965 44 p refs In GERMAN
(DESY-65/14)

Calculations of radiative corrections to e–p–scattering are performed for experiments in which the final particles are detected in coincidence and both the angles and energies of the outgoing particles are measured. The dependence of radiative corrections on angle and energy resolution parameters is discussed in detail. Author (NSA)

N66-26028# Purdue Univ., Lafayette, Ind.
CHARGE AND MASS DISTRIBUTION STUDIES IN THE FISSION OF Np^{237} AND Pu^{239} BY INTERMEDIATE ENERGY HELIUM IONS
Ned Allen Wogman (Ph.D. Thesis) Jan. 1966 292 p refs
(Contract AT(11-1)-347)
(COO-347-18) CFSTI: HC $6.00/MF $1.50

The fission of ^{237}Np and ^{239}Pu induced by helium ions in the energy range from 20.0 to 40.5 Mev was studied radiochemically. The charge distribution, mass distribution, and absolute fission cross sections were determined. NSA

N66-26033# Pennsylvania Univ., Philadelphia. Dept. of Physics.
HIDDEN SYMMETRIES AND THE QUESTION OF MASSLESS PARTICLES
S. A. Bludman Aug. 1962 26 p refs Presented at Tokyo Summer Inst. of Theoret. Phys., Oiso, Japan, 17 Sep. 1965
(Contract AT(30-1)-3489)
(CONF-650927-21) CFSTI: HC $2.00/MF $0.50

The dynamical breakdown of symmetry is considered. In this the Goldstone theorem, which states that if a continuous symmetry is broken by the vacuum, then there must exist massless excitations of a definite symmetry character determined by the broken symmetry, is treated. The merits of the hidden symmetry approach are that states which do not transform covariantly under the group are admitted while maintaining the symmetry of the lagrangian, and the existence of massless particles is apparently associated with an invariance principle. It is shown that while the theorem is formally true, under conditions which themselves assume something about the dynamics, nevertheless no physical conclusion can be drawn directly from the broken symmetry alone. This is not to deny that massless particles may very well appear in broken symmetry theories as a consequence of a dynamical calculation or approximation. NSA

N66-26039# European Atomic Energy Community, Geel (Belgium).
ON THE DECAY OF ^{241}Am — INTENSITY OF CONVERSION ELECTRONS IN 26.4 KEV AND 33.2 KEV PASSAGES IN ^{237}Np [ZUM ZERFALL DES ^{241}Am—DIE INTENSITAT DER KONVERSIONSELEKTRONEN DES 26.4 KEV- UND DES 33.2 KEV-UBERGANGS IM ^{237}Np]
W. Bambynek 16 Nov. 1965 36 p refs In GERMAN
(EUR-2632.d)

Data on the decay of ^{241}Am published in literature are reviewed. It is shown that the absolute intensities of the conversion electrons of the 26.4 and the 33.2 kev transitions, which were calculated from measured β-spectrometer data, are too small by nearly a factor of 2. On the other hand the intensities $e(26)=(23.9\pm6.7)$ and $e(33)=(26.4\pm6.6)\%$, which were calculated essentially from α- and γ-intensities, could be confirmed by the measurements. The conversion coefficient $\alpha(26)=9.5\pm3.4$ deduced from these figures is about 3 times larger than that calculated by Sliv and Band or Rose. Author (NSA)

N66-26040# Paris Univ., Orsay (France). Laboratoire de l'Accelerateur Lineaire.
PROTON FORM FACTORS FROM PROTON OBSERVATION
D. Prerejacque, D. Benaksas, and D. Drickey 1965 25 p refs Submitted for Publication
(LAL-1144)

A determination of the electric and magnetic form factors of the proton was made by studying the elastic scattering of electrons from a polyethylene target by observation of the recoiling proton at 0 and 30° for values of q^2 between 1 and 1.8 fermi^{-2}. From these measurements, the charge radius and the magnetic radius of the proton were determined; the two radii are equal within the experimental errors. NSA

N66-26042# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.
CASIMIR OPERATORS FOR U(n) AND SU(n) GROUPS [OPERATORY KAZIMIRA DLYA GRUPP U(n) I SU(n)]
A. M. Perelomov and V. S. Popov 1965 32 p refs In RUSSIAN; ENGLISH summary *Its* Rept. No.-338
(NP-15764)

A simple method of finding the eigenvalues of the invariant operators (Casimir operators) C_p of arbitrary order p for the U(n) and SU(n) groups is developed. The relations between Casimir operators for the U(n) and SU(n) groups is established. Explicit formulas for the operators C_p with $p\leq6$ are given. Author (NSA)

N66-26046# Polish Academy of Sciences, Warsaw. Central Lab. for Radiological Protection.
THE DETERMINATION OF A MIXTURE OF THERMAL-NEUTRON AND GAMMA-RAY EXPOSURES BY FILM-BADGES
T. Musialowicz, J. Wysopolski, and B. Filipiak 26 Nov. 1965 24 p refs
(CLOR/IBJ-42/D) CFSTI: HC $1.00/MF $0.50

This report describes the film-badge measurement method of combined thermal neutrons and gamma-rays using a 0.5 mm Cd converter and a 0.6 mm Sn filter. The relation between the film density equivalent values for gamma and thermal neutron doses has been determined. The experimentally found coefficients for estimation of the components of the whole dose on the basis of the calibration curve of Ra-226 are: for thermal neutrons $k_{Cd\text{-}Sn}=2.2$, and for gamma radiation

k_{Sn}=0.5. The relative error of the thermal neutron dose determined in about 700 cases, ranging from 40 mrem to 3500 mrem, was within the limits: −35%++220% for doses determined −35% on the bases of the neutron calibration curve, and −45%++95% for doses determinex on the basis of the gamma calibration curve. C.T.C.

N66-28058# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
PREIONIZATION OF HYDROGEN BY RADIATION [STRAHLUNGSVORIONISIERUNG VON WASSERSTOFF]
G. Hofmann Mar. 1966 70 p refs In GERMAN; ENGLISH summary
(IPP-1/43) CFSTI: HC $3.00/MF $0.75

A light source was developed which emits a very intense short radiation pulse below 800 Å. By this device molecular hydrogen could be ionized sufficiently to be used as the starting point for a heating experiment (theta pinch). This light source is a fast high voltage z-pinch which is filled dynamically, only for the duration of the ionizing light pulse, with dense lithium vapor. The electron density of the photoionized hydrogen was measured with a Microwave-Interferometer, the electric conductivity was determined from the skin-effect. In the center of a tube of 150 cm length and 4 cm radius a degree of ionization of 4.5% can now be reached with an initial pressure of 0.01 Torr H_2 using two light sources at both ends. The conductivity is so high that a magnetic field of 500 kHz penetrates only 0.5 cm. The electron temperature was determined from the conductivity as some eV while the ions remain cold. Author

N66-28063# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
ELECTRON IMPACT IONIZATION CROSS SECTIONS AND IONIZATION RATE COEFFICIENTS FOR ATOMS AND IONS
Wolfgang Lotz Apr. 1966 117 p refs
(IPP-1/47) CFSTI: HC $4.00/MF $0.75

All available experimental data on cross sections for single ionization of atoms and ions from the ground state by electron impact in the low energy range ($\leq$10 keV) have been collected. For each species a best fit curve has been drawn. By comparison of isoelectronic species as well as of equally charged species it is possible to make predictions for yet unknown cross sections. Ionization rate coefficients for all species in the triangle H I–Na I–Na XI are given with an estimated error of $^{+40}_{-30}$%. Author

N66-28187# International Centre for Theoretical Physics, Trieste (Italy).
NON-COMPACT EXTENSIONS OF SYMMETRY GROUPS
P. Budini 3 Dec. 1965 14 p refs Submitted for Publication (IC/65/85)

An attempt is made to give a general method for obtaining the mass formula once the symmetry algebra of the system is known, and this is applied to simple systems. The harmonic oscillator and the hydrogen atom are considered. It is shown that the noncompact extension of symmetry algebras can not only generate the eigenstates spectrum of the physical system, but it can also furnish a method for obtaining mass formulas exact in the frame of the symmetry, the degeneracy of the invariants being connected to the degeneracy of the multiplets. One general condition is that the mass operator does not commute with some of the operators of the noncompact algebra or, exceptionally, be contained in the compact one. NSA

N66-28190# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
A RELATIVISTIC COMPOSITE MODEL OF MESON AND BARYON RESONANCES [RELYATIVISTSKAYA SOSTAVNAYA MODEL VYSSHIKH MEZONNYKH I BARIONNYKH REZONANSOV]
P. N. Bogolyubov, V. A. Matveev, and B. V. Struminskii 1965 21 p refs In RUSSIAN
(JINR-P-2442)

A relativistic composite model of mesons and baryons is developed. Highest meson resonances are considered as bound states in the p-wave of the quark-antiquark system, and baryon resonances as bound states in the p-wave of the three-quark system. Some mass relations are obtained, on the basis of which new particles are predicted. The electromagnetic interactions of new resonances are studied under the assumption of a minimal electromagnetic interaction of quarks. Author (NSA)

N66-28191# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
AN OCTET OF BARYON RESONANCES IN UNITARY SYMMETRY SCHEME [OKTET BARIONNYKH REZONANSOV V SKHEME UNITARNOI SIMMETRII]
O. G. Bokov 1965 7 p refs In RUSSIAN
(JINR-P-2444)

Decays of an octet of resonances $J^P=3/2^-$ into octets of baryons and pseudoscalar mesons are treated under the SU(3) symmetry. Relations are obtained between the coupling constants of the fields and the decay widths. A comparison of the obtained results with the available experimental data favors an assignment to an octet of the resonance Λ (1668) not yet found experimentally by comparison with the well-known isotopic singlet Λ (1520). Author (NSA)

N66-28192# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
A POSSIBLE TEST OF CPT INVARIANCE IN $\bar{p}$–p SCATTERING
S. M. Bilenky 1965 5 p refs Submitted for Publication (JINR-E-2457)

A method is suggested to test the CPT-invariance in $\bar{p}$–p scattering. The method is essentially as follows: the antiproton (proton) polarization in scattering of unpolarized antiprotons by unpolarized protons is compared with the asymmetry in scattering of unpolarized antiproton beam by a polarized proton target (a polarized beam by an unpolarized target). Author (NSA)

N66-28193# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
AN EXPERIMENTAL DETERMINATION OF RELATIVE PROBABILITIES OF $K_2^0 \rightarrow 3\pi^0$ DECAYS [EKSPERIMENTAL'NOE OPREDELENIE OTNOSITEL'NOI VEROYATNOSTI RASPADA $K_2^0 \rightarrow 3\pi^0$]
A. N. Mestvirishvili, D. Nyagu, N. Petrov, V. Rusakov, and Tsung-Fan Wu 1965 11 p refs In RUSSIAN
(JINR-P-2450)

On the basis of the identification of 29 Dalitz pairs among 7520 V^0 events from the decay of long-lived neutral K mesons

recorded in the magnetic cloud chamber, the relative probability of $K_2^0 \to 3\pi^0$ decay was determined. It was found to be $W(K_2^0 \to 3\pi^{2o})/(K_2^0 \to \text{charged products}) = (31^{+7}_{-6})\%$.
Author (NSA)

N66-26194# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
PROTON-ANTIPROTON SCATTERING IN SU(6)$_W$ SYMMETRY [PROTON-ANTIPROTONNOE RASSEYANIE V SU(6)$_W$ SIMMETRII]
Dao Wong Duc 1965 5 p refs In RUSSIAN
(JINR-P-2469)

The proton-antiproton scattering process in SU(6)$_W$ symmetry is considered. Simple relations for the differential cross sections (forward, backward) are found. They can be verified with experiment. Author (NSA)

N66-26195# Joint Inst. for Nuclear Research, Dubna (USSR).
REPRODUCTION OF KINEMATICAL PARTICLE PARAMETERS BY CHAMBER PICTURES WITH ACCOUNT OF INHOMOGENEITY OF MAGNETIC FIELD, ENERGY LOSSES, AND COULOMB SCATTERING [VOSPROIZVEDENIE KINEMATICHESKIKH PARAMETROV CHASTITS PO SNIMKAM SLEDOV V TREKOVYKH KAMERAKH S UCHETOM NEODNORODNOSTI MAGNITNOGO POLYA, POTER ENERGII I KULONOVSKOGO RASSENYANIYA]
V. F. Vishnevskii and I. M. Ivanchenko 1965 6 p refs In RUSSIAN
(JINR-P-2467)

A method is described for computer calculations of kinematical parameters of particles from track measurements on track chamber pictures taking into account the inhomogeneity of the magnetic field, energy losses, and Coulomb scattering. Author (NSA)

N66-26196# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
DETERMINATION OF RELATIVE PROBABILITY OF $K_2^0 \to \pi^\mp + e^\pm + \nu(\bar{\nu})$ DECAY [OPREDELENIE OTNOSITEL'NOI VEROYATNOSTI RASPADA $K_2^0 \to \pi^\mp + e^\pm + \nu(\bar{\nu})$]
A. N. Mestvirishvili, D. Nyagu, N. I. Petrov, V. A. Rusakov, and Tsung-Fan Wu 1965 4 p refs In RUSSIAN
(JINR-P-2449)

The relative probability of the $K_2^0 \to \pi^\mp e^\pm + \nu(\bar{\nu})$ decay was determined by means of a cloud chamber in the magnetic field. Use was made of the identification of the decay electrons by the momentum loss which they suffer in passing through a lead plate 5.8 g/cm^2 thick which is placed in the middle of the fiducial volume of the chamber.
Author (NSA)

N66-26197# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
LEPTONIC DECAY OF THE Ω^--HYPERON IN THE QUARK MODEL [LEPTONNYE RASPADY Ω^--GIPERONA V MODELI KVARKOV]
F. F. Tikhonin 1965 6 p refs In RUSSIAN
(JINR-P-2445)

The leptonic decay of a Ω^--hyperon is considered on the basis of the quark model. An expression for the decay width $\Omega^- \to \Xi^0 + e^- \nu$ is obtained. Author (NSA)

N66-26198# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
TIME AND ENERGY IN QUANTUM MECHANICS
M. I. Shirokov 1965 12 p refs
(JINR-E-2478)

Time and energy are conjugate operators (like coordinate and momentum) in a theory based upon all the usual quantal postulates preceding the Schroedinger equation. In treating a physical system obeying this equation, time may be considered as a parameter. The relation $\Delta E \Delta t \approx h$ and the problem whether the energy of an isolated system is conserved in time are discussed. Author (NSA)

N66-26199# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
INTERNUCLEAR CASCADES AT SUPERHIGH ENERGIES [VNUTRIYADERNYE KASKADY PRI SVERKHVYSOKIKH ENERGIYAKH]
I. Z. Artykov, V. S. Barachenkov, and S. M. Eliseev 1965 6 p refs In RUSSIAN
(JINR-P-2472)

It is shown that the generally accepted model of internuclear cascades considered as series of independent two-particle interactions for $T >> 10$ Bev is in a strong disagreement with experiment. The difference is mainly due to the contribution of a leading core particle. Author (NSA)

N66-26201# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
FORBIDDEN CONFIGURATIONS IN A THREE-PHOTON SYSTEM [ZAPRESHCHENNYE KONFIGURATSII V SISTEME TREKH FOTONOV]
G. I. Kopylov 1965 13 p refs In RUSSIAN
(JINR-P-2447)

The effective matrix elements of decay of particles with spin 0 and 1 into three photons are listed. It is proved in a general form that the spin 0 unlike the spin 1 and 2, forbids the collinear configurations and the configurations with monoenergetic photons. Characteristic distributions over the photon energies are given. Author (NSA)

N66-26202# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
γ-QUANTA DETECTING BY USING A SPARK CHAMBER AND TOTAL ABSORPTION CHERENKOV COUNTER [DETEKTIROVANIE γ-KVANTOV S POMOSHCH'YU ISKROVOI KAMERY I CHERENKOVSKOGO SCHETCHIKA POLNOGO POLGOSHCHENIYA]
M. A. Azimov, V. G. Kolesnik, V. S. Pantuev, L. V. Sil'vestrov, and M. N. Khachaturyan 1965 8 p refs In RUSSIAN
(JINR-P-2436)

A system consisting of a thin spark chamber and a total absorption Cherenkov counter is used to detect γ quanta from the decay of 3- to 5-Bev π^0 mesons. The accuracy of determining the γ energy is $\pm 5\%$, and the accuracy of determining the γ emission angle is $\pm 0.4°$. The spark chamber is triggered from the Cherenkov counter, permitting the efficiency of selecting γ events in the charged pion beam to be improved considerably. Author (NSA)

N66-26203# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ELECTROMAGNETIC CURRENT AND FORM FACTORS FOR THE MESON 35-PLET IN THE SL(6,C) SYMMETRY
P. Winternitz, A. L. Zubarev, and A. A. Makarov 1965 7 p refs Submitted for Publication
(JINR-E-2475)

The structure of the electromagnetic meson current is investigated in the framework of the SL(6,c) symmetry and it is shown that the current depends on three form factors. The results are compared with the U(6,6) theory. Author(NSA)

N66-26232*# Harvard Coll. Observatory, Cambridge, Mass.
CONTINUOUS ULTRAVIOLET ABSORPTION BY NEUTRAL SILICON Scientific Report No. 10
John C. Rich Apr. 1966 45 p refs
(Grant NSG-438; Contract Nonr-1866(48))
(NASA-CR-74908) CFSTI: HC $2.00/MF $0.50 CSCL 20H

Photoionization cross sections (bound-free absorption coefficients) have been measured for the $3s^2\ 3p^2\ {}^3P$ ground state and ^1D excited level of the neutral silicon atom. The measurements, made in absorption with the use of reflected shock techniques, yield cross sections of about 37 and 34 megabarns (10^{-18} cm^2) respectively, near the ionization limits. Theoretical quantum defect calculations give satisfactory comparisons. The next excited ^1S level is discussed.
Author

N66-26386# Brookhaven National Lab., Upton, N. Y.
LORENTZ COVARIANT DEFINITION OF THE U_6 GROUP FOR FREE PARTICLE STATES
F. Gursey (Middle East Tech. Univ.) and L. A. Radicati Jan. 1965 10 p refs Submitted for Publication
(BNL-8767) CFSTI: HC $1.00/MF $0.50

Two sets of covariantly defined operators X_i^R, X_i^L obeying the covariant commutation laws for the angular momentum are derived. It is shown that X_i^L and X_i^R are the generators of little group transformations for the vectors of the representations [m,0] ⊗ D(s,0) and [m,0] ⊗ D(0,s) discussed by Shaw. The generators of SU(6) are then constructed as non-hermitian operators in the Shaw representation and hermitian operators in the Wigner representation. Because the little group operators are constants of the motion, they can be represented as three dimensional surface integrals of tensor densities with vanishing divergence. These integrals are given explicitly for a Dirac field. NSA

N66-26388# International Centre for Theoretical Physics, Trieste (Italy).
A NEW APPROACH TO ALGEBRA OF CURRENT OPERATORS
P. Narayanaswamy, T. Pradhan, and T. S. Santhanam 25 Jan. 1966 23 p refs
(IC/66/3)

The charge independent interaction between the eight known baryons and mesons is expressed in terms of the eight baryon current densities. The non-relativistic limits of the vector, pseudoscalar, and pseudovector currents were discussed. It is found that with eight baryons one can construct 8 currents which form the SU(3) algebra and also 64 currents which form the U(8) algebra. NSA

N66-26390# International Centre for Theoretical Physics, Trieste (Italy).
A RELATIVISTIC U(6,6) THEORY
Abdus Salam and J. Strathdee 31 Jan. 1966 23 p refs Submitted for Publication
(IC/66/5)

Infinite-dimensional unitary representations of the non-compact group U(6,6) are employed to classify elementary particles and, following ideas related to those of Fronsdal, are used to construct relativistic S-matrix elements. Like the previously treated relativistic theories where finite-dimensional representations of U(6,6) were used, a particular S-matrix element shows no symmetry higher than that of the appropriate hybrid subgroup. The overall U(6,6) symmetry may give new relations between form factors for different processes but will not, in general, give anything beyond the results of the previous formulations for the scattering processes. The unitarity of the S-matrix is compatible with the subgroup hierarchy, provided that an infinity of multiplets for elementary particles exists and provided that all such multiplets possess the same mass. The crucial point of the formulation is that if mass differences are introduced, these affect not the relativistic invariance but the unitarity of the S-matrix. Author (NSA)

N66-26391# International Centre for Theoretical Physics, Trieste (Italy).
ON THE ELECTROMAGNETIC AND WEAK FORM FACTORS OF THE NUCLEON
G. Cocho 31 Dec. 1965 12 p refs Submitted for Publication
(IC/65/95)

The electromagnetic and weak form factors of the nucleon are fitted with a pole model which includes a phenomenological cutoff. The physical masses of the ρ, ω, and ϕ resonances and the coefficient given by U(6)⊗U(6) are used.
Author (NSA)

N66-26396# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF THE 2^1S STATE OF HELIUM USING THE HARTREE-FOCK METHOD [ETUDE DE L'ETAT 2^1S DE L'HELIUM PAR LA METHOD DE HARTREE-FOCK]
Jean-Leon Masse Oct. 1965 18 p refs In FRENCH
(CEA-R-2855)

The Hartree–Fock method has been widely applied to atoms and molecules. However, it raises special objections as regards excited states which generally include incompletely filled orbital groups. Particularly, in such a case, the hypothesis of orthogonal orbitals, which is generally admitted and which makes the formalism and the solution of equations far simpler, is not possible in any case. The terms (1s) (ns), n^1S of helium, for n=2,3... show a simple example where the orbitals can no longer be supposed to be orthogonal. The Hartree–Fock equations were solved for the (1s) (2s), 2^1S state, with the approximation of linear combinations of orbitals of a Slater-type. Author (NSA)

N66-26397# Japan Atomic Energy Research Inst., Tokyo.
PROGRAM ELIESE-1: FORTRAN-II PROGRAM FOR ANALYSES OF ELASTIC AND INELASTIC SCATTERING CROSS SECTIONS
Nov. 1965 87 p refs
(JAERI-1096)

The program ELIESE-1 can be used for calculating any kinds of cross sections for elastic and inelastic scatterings of neutrons, protons and alpha particles by means of the optical model and of the Hauser–Feshbach's method in the compound nuclear process. Author (NSA)

N66-26398# Instituto de Energia Atomica, Sao Paolo (Brazil). Nuclear Physics Div.
PARAMAGNETIC STUDIES OF HOLMIUM BY NEUTRON TOTAL CROSS SECTION MEASUREMENTS
Marieta C. Mattos Aug. 1965 12 p refs Presented at the 5th Rare Earth Conf., Ames, Iowa, Aug. 1965
(IEA-99; CONF-650804-31)

The total neutron cross section for holmium was measured for neutron wavelengths between 0.20 and 9.00 Å. The IEA crystal spectrometer was used together with a mechanical velocity selector to eliminate higher order reflections from the crystal. Powder samples of Ho_2O_3 were prepared in high purity, taking particular care to eliminate contamination by the rare earths of high neutron cross section. Although paramagnetic form factors are usually determined by differential cross section measurements with one neutron wavelength, accurate total cross section measurements for a wide range of known wavelengths give definite information on the radius of the 4f electron orbits. Measurements indicate a radius different from the one used by Blume, Freeman and Watson, who calculated the form factor assuming hydrogenic wave functions. The possible choice of different screening constant is discussed. Author (NSA)

N66-26403# United Kingdom Atomic Energy Authority, Culham (England). Research Group.

ELECTRIC FIELD DISSOCIATION OF H_2^+

H. Wind Sep. 1965 60 p refs

(CLM-R46) HMSO: 8s

When an electric field of sufficient strength is applied H_2^+ dissociates into H^0+H^+. The probability of this process was computed. For intermediate steps the electronic energy in the field of two coulomb-centers and the energy levels of H_2^+ are also derived. Two methods are described which were used to observe field dissociation. The new data resulting from these are: (1) There is a threshold electric field. This confirms the theory that H_2^+ has a finite number of states, (2) It is possible to detect individual levels. (3) It is possible to estimate the population of these levels. The agreement between theory and experiment is good. Author (NSA)

N66-26440# Naval Radiological Defense Lab., San Francisco, Calif.

LEVELS OF Sr^{85} POPULATED IN THE DECAY OF Y^{85} AND Y^{85m}

Daniel J. Horen and W. H. Kelly (Michigan State Univ.) 14 Mar. 1966 44 p refs

(USNRDL-TR-962; AD-629576) CFSTI: HC $4.60/MF $0.50

Evidence is presented for the existence of two isomers in Y^{85} with half-lives of 2.9±0.2-h and 4.7±0.2-h. Positron, photon and X-ray measurements, both singles and coincidence, were performed. No evidence was obtained for the existence of an isomeric transition between the two isomers. A tentative decay scheme for 2.9-h Y^{85} is presented which includes levels in Sr^{85} at 0.237(Sr^{85m}), 1/2−, 0.740 (1/2−, 3/2−) and 1.152 (1/2−, 3/2−) MeV. A decay scheme for 4.7-h Y^{85} is proposed with levels at 0.231 (7/2+), 0.769, (0.802), 1.263, 1.353, 1.556, 1.630, 2.118, 2.169, (2.329), 2.351 and 2.779 MeV. Consideration of the data suggests that 2.9-h Y^{85} has spin and parity 1/2−, and lies approximately 0.040 MeV above 4.7-h Y^{85} which has spin and parity 9/2+. The log ft values suggest that most of the levels populated in the 4.7-h decay have spins and parities 7/2+, 9/2 or 11/2+, the latter being less preferred because of the photon branching ratios. Although additional experimental data are required to make possible a detailed comparison with the even parity level structure of SR^{85} as predicted by Talmi and Unna (Nucl. Phys. 19:225 (1960)), the apparent preponderance of levels with spins between 7/2 and 11/2 indicates one might expect poor agreement. Author (TAB)

N66-26451# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

DETERMINATION OF THE $\pi\pi$ SCATTERING PHASE SHIFTS UP TO 1.3 GeV CMS ENERGY

Gunter Wolf Oct. 1965 18 p refs

(DESY-65/13)

The experimental data on elastic $\pi\pi$ scattering were combined and analyzed in terms of the $\pi\pi$ scattering phase shifts up to cms energies of the $\pi\pi$ system of 1.3 BeV. Most of these data come from the application of the one-pion exchange model to reactions of the type $\pi N \rightarrow \pi\pi N$. The analysis resulted in a set of phase shifts which give a good fit to the existing data. For the width of the meson (ρ) a value of 170 MeV was obtained. The behavior of the asymmetry parameter $R=(F-B)/(F+B)$ in $\pi^+\pi^-$-scattering implies the existence of a $T=0$, $J=0\pi\pi$ resonance. A mass of 0.74 BeV and a width of 90 MeV were found for this resonance. Author (NSA)

N66-26453# California Univ., Livermore. Lawrence Radiation Lab.

THE ELECTROMAGNETIC MASS OF THE CLASSICAL ELECTRON

J. W. Zink 7 Jan. 1965 21 p refs

(Contract W-7405-ENG-48)

(UCRL-12233) CFSTI: HC $1.00/MF $0.50

The difference between the electrostatic mass of classical electron, m_0, and the electrodynamic mass, $(4/3)m_0$, has caused a considerable amount of confusion because the theory of relativity seems to predict that, in the limit of small velocities, the two masses should be the same. It is shown that within the structure of relativity the two masses should not necessarily be the same. The nature of each of the two masses is brought out. Author (NSA)

N66-26457# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.

INVESTIGATION OF SCINTILLATION COUNTER EFFECTIVENESS IN REGISTERING NEUTRONS WITH SEVERAL BeV ENERGY [ISSLEDOVANIE EFFEKTIVNOSTI REGISTRATSII NEITRONOV S IMPUL'SOM NESKOL'KO BeV/s STSINTILL-YATSIONNYMI SCHETCHIKAMI]

Yu. V. Galaktionov, L. G. Landsberg, and V. A. Lyubimov 1965 8 p ref In RUSSIAN; ENGLISH summary *Its* Rept.-372

(NP-15786)

The efficiency of BeV-neutron registration by scintillation counters was investigated. The detectors with efficiency of 0.5 to 0.7 BeV-neutrons were described. Author (NSA)

N66-26460# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.

LATENT SYMMETRY OF HYDROGEN ATOM [O SKAYTOI SIMMETRII ATOMA VODORODA]

A. M. Perelomov and V. S. Polov 1965 22 p refs In RUSSIAN; ENGLISH summary *Its* Rept. No.-378

(NP-15793)

Dynamical symmetry of the hydrogen atom is considered from the group-theoretical point of view. Transition from the compact group O(4) to its noncompact analog (the Lorentz group) makes it possible to describe discrete and continuous spectra of the hydrogen atom. It is shown that wave functions of the continuous spectrum form the infinite-dimensional irreducible representation $D(O,\rho)$ of the Lorentz group ($\rho=\sqrt{2}/E$) belonging to the so-called "main series" of unitary representations. Wave functions of the discrete

spectrum with given principal quantum number η form the finite-dimensional representation D[(n−1/2), (n−1/2)] of the Lorentz group. A peculiar symmetry of the wave functions of the continuous spectrum in the case of Coulomb potential is found. The special case of the states with E=0 (in attractive Coulomb potential) when the Lorentz group contracted into nonrelativistic Galilei group is also considered.
Author (NSA)

N66-26463# Argonne National Lab., Ill.
USE OF BEAMS OF POLARIZED DEUTERONS AND DETERMINATION OF THE PARAMETERS OF AN OPTICAL MODEL [UTILISATION DE FAISCEAUX DE DEUTONS POLARISES ET DETERMINATION DES PARAMETRES DU MODELE OPTIQUE]
Jacques Raynal Dec. 1965 115 p refs Transl. into ENGLISH of Report CEA-R-2511
(ANL-Trans-258)

A descriptive formalism of a generalized polarized beam is presented. Any reaction whatsoever is described in terms of a collision matrix written in helical formalism. The optical model is discussed for particles of spin 1. The discussion includes possible potential forms, separation into partial waves, resolution of partial wave equations, diffusion amplitudes, and approximate calculations. A Watanabe calculation of the effective potential for deuterons is presented. Also generalization of the calculation of form factors are discussed. Optical model calculations were made with simple form factors, central potentials and free LS coupling, and a nucleon–nucleus potential.
NSA

N66-26469# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
EMISSION AND EXCITATION CROSS SECTIONS Progress Report, 1 Mar.–30 Nov. 1965
E. W. Thomas and G. D. Bent 1 Dec. 1965 37 p refs *Its* Tech. Status Rept. No. 1
(Contract AT(40-1)-2591)
(TID-22480) CFSTI: HC $2.00/MF $0.50

Excitation and emission cross sections for atomic reactions of 0.15- to 1-Mev protons on helium are measured. The design of the instrumentation, beam transport systems, and target assembly required for these measurements is outlined.
NSA

N66-26472# International Centre for Theoretical Physics, Trieste (Italy).
LECTURES ON THE ANALYTIC STRUCTURE OF MANY-PARTICLE SCATTERING AMPLITUDES. PART I: DISCONTINUITY EQUATIONS
Henry P. Stapp Feb. 1965 44 p refs
(IC/65/17)

A dispersion formula is discussed for a function regular in a product of cut planes. A conjecture for the general form of the analytic structure of multiparticle scattering amplitudes is discussed. The elementary discontinuity equation is discussed in some detail. An analytic basis of the back-up rule is presented. Also, maximum analyticity and the generalized Mandelstam representation are discussed.
NSA

N66-26478# Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh.
FURTHER STUDY OF NUCLEAR RESONANT SCATTERING USING NEUTRON-CAPTURE GAMMA RAYS
G. Ben-David, B. Arad, J. Balderman, and Y. Schlesinger Aug. 1965 35 p refs
(IA-1050)

The study of resonance scattering of neutron capture gamma rays was extended using 22 capture gamma sources and 57 scattering targets. About fifty resonance scattering events were observed in 23 elements and the effective cross sections evaluated. Some cases of complex spectra are described. The association of the scattering with nuclei in the region of closed shells is clearly shown. Problems of minimum observable cross sections are discussed and some further applications of the technique are suggested. Author (NSA)

N66-26645*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXCITATION OF HYDROGEN MOLECULES BY ELECTRON IMPACT
S. P. Khare Mar. 1966 22 p refs
(NASA-TM-X-55474; X-640-66-142) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Using one-center wave functions for the hydrogen molecule together with the Born and Ochkur approximations, the excitation of the molecule from the ground state to the B and C electronic states by electron impact has been investigated. The shape of the curves for the differential cross section and for the oscillator strength is in accord with the experimental results of Geiger. The effect of exchange is to reduce the scattering cross sections.
Author

N66-26646*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRON-HYDROGEN IONIZATION: ASYMPTOTIC FORM OF THE WAVE FUNCTION AND THE THRESHOLD BEHAVIOUR OF THE CROSS SECTION
A. Temkin 4 Feb. 1966 20 p refs
(NASA-TM-X-55473; X-641-66-46) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The asymptotic form of the wave function for (S-wave) electron-hydrogen ionization is examined and found not to obey the correct boundary condition at $r_1=r_2$. In addition, the quantity by which it differs from being an exact solution becomes infinitely large as $r_1 \to r_2$. On the basis of the zeroth order problem of the nonadiabatic theory of electron-hydrogen scattering other solutions are shown to exist. Within this approximation we show how a fully satisfactory solution of the Schrodinger equation can be constructed, and we indicate that it leads to an $E^{3/2}$ threshold law for ionization. Furthermore, it lends itself to a natural generalization for the asymptotic form of the full S-wave problem which continues to suggest a nonlinear threshold dependence for the complete problem.
Author

N66-26733# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Laboratori Nazionali di Frascati.
ACTIVITY AT THE NATIONAL LABORATORIES OF FRASCATI, JULY 1, 1964–JUNE 30, 1965
Aug. 1965 34 p refs
(LNF-65/28) CFSTI: HC $2.00/MF $0.50

Study and experimentation is reported in elementary particle physics. Scientific and technological investigations were carried out in the following areas: high energy nuclear physics; storage rings; linear accelerators; machines, cryogenics; magnetic measurements; electronics; nuclear technology; health physics; and computations.
D.T.

N66-26739# Academy of Sciences of the Latvian SSR, Riga.
ELECTRON-ATOMIC COLLISIONS [ELEKTRONNO-ATOMNYYE STELKNOVENIYA]
1965 148 p refs In RUSSIAN CFSTI: HC $4.00/MF $1.00

This issue of the periodical *Electron-Atomic Collision* contains the following articles: (1) ionization of atoms by electronic impact; (2) ionization of the hydrogen atom; (3) effect of distorted attenuated waves on partial section of ionized hydrogen atom; (4) exchange of electrons in a collision of electrons with atoms; and (5) optical theorem for n-valence space. Transl. by K.W.

N66-26744# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Laboratori Nazionali di Frascati.
THEORETICAL ASPECTS OF COLLIDING BEAM EXPERIMENTS
R. Gatto 5 Aug. 1965 42 p refs Presented at the Intern. Symp. on Electron and Photon Interactions at High Energies, Hamburg, 8–12 Jun. 1965 *Its* Nota Interna. No. 284
(LNF-65/25)

Electron–positron and electron–electron collisions and their products are discussed. Among the electromagnetic reactions investigated are: vacuum polarization effects; annihilations into strong interacting particles, pions, and fermion pairs; resonant contributions; one-photon and two-photon channels; and weak vector-meson production and weak interactions. Diagrams of the various interactions, and graphs of differential cross sections. Bremsstrahlung spectrum and angular distribution, and annihilation cross sections are presented. N.E.N.

N66-26794# Los Alamos Scientific Lab., N. Mex.
MOLECULAR AND PRINCIPAL SERIES ABSORPTION IN CESIUM–ARGON MIXTURES
J. E. Sollid 28 Jan. 1966 24 p refs
(Contract W-7405-ENG-36)
(LA-3391-MS) CFSTI: HC $2.00/MF $0.50

An experimental study of the absorption spectrum of cesium–argon gaseous mixtures was made. Cesium pressures ranged from 1 to 5 torr and argon pressures from 5 to 1520 torr. The absorption intensities of the cesium principal-series resonance lines were observed to decrease with increasing argon pressure, but cesium molecular absorption remained unchanged. It was concluded that the change in line intensities is not due to an argon-induced change in the cesium vapor pressure. Quantitative results are given for molecular absorption. Line broadening effects in cesium are discussed. A bibliography with 55 references to works on molecular structure, line broadening, and foreign gas effects is presented. Author (NSA)

N66-26805# California Univ., Berkeley. Lawrence Radiation Lab.
PHYSICS DIVISION SEMIANNUAL REPORT, MAY–OCTOBER 1965
10 Nov. 1965 62 p refs
(Contract W-7405-ENG-48)
(UCRL-16511) CFSTI: HC $3.00/MF $0.75

Summarized data are presented on several general physics research projects. Study areas covered include bubble chambers, data reduction, three-body leptonic decays, scattering theory, particle and space research, dynamic calculations and symmetry studies in strong interaction particle physics, spark chambers, proton–proton elastic scattering, atomic beams, and health physics. Reports are also presented on accelerator operation and development, covering the bevatron, 184-inch and 88-inch cyclotrons, and the electon linear accelerator. M.G.J.

N66-26811# Stanford Univ., Calif. Linear Accelerator Center.
INFINITE LADDERS AND THE ALGEBRA OF INTEGRATED CURRENT COMPONENTS
H. Harari Jan. 1966 20 p refs
(Contract AT(04-3)-515)
(SLAC-58) CFSTI: HC $1.00/MF $0.50

Possible relations between various proposed current algebras and some non-compact groups which may generate infinite ladders of particle states are discussed. In particular the possibility of identifying the compact algebra of currents with the compact version of the non-compact spectrum-generating algebra is studied. Some examples based on the SU(3), SU(4), and SU(6) current algebras are considered, and it is shown that the particles within the first few "levels" of the obtained infinite ladders approximately fall into finite representations of the relevant current algebras. NSA

N66-26813# Stanford Univ., Calif. Linear Accelerator Center.
MAGNETIC FIELD MEASUREMENT AND SPECTROSCOPY IN MULTIPOLE FIELDS
J. K. Cobb and J. J. Muray Nov. 1965 93 p refs Supersedes SLAC-39
(Contract AT(04-3)-400)
(SLAC-39, Rev.; SLAC-39) CFSTI: HC $3.00/MF $0.75

The techniques used to measure magnetic field parameters in the strong-focusing lenses of the Stanford Linear Accelerator are reviewed. Specifically, the theory and techniques used to determine such parameters as the magnetic center multipoles, the length of the gradient fields, and the harmonic content in strong-focusing lenses are described. The calculation of the optical properties of a magnet from the measured parameters is also outlined. NSA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N66-25411# United Kingdom Atomic Energy Authority, Culham (England). Research Group.
SCATTERING OF ELECTROMAGNETIC WAVES BY ELECTROACOUSTIC PLASMA WAVES
P. F. Little and S. M. Hamberger 1965 12 p refs Submitted for Publication
(CLM-P95)

In this experiment a beam of 8 mm microwave is scattered by self-excited longitudinal oscillations in a plasma column. From the frequency shift and the angular dependence of the scattered radiation we deduce a dispersion plot for the plasma waves. This agrees with an independently measured dispersion plot obtained using two Langmuir probes to observe the density fluctuations directly. Author

N66-25412# Technische Hogeschool, Eindhoven (Netherlands).
THE STABILITY OF A PINCH DISCHARGE, WITH FINITE SOUND VELOCITY, IN A ROTATING MAGNETIC FIELD
Frank Geert Beiboer [1966] 123 p refs CFSTI: HC $4.00/MF $1.00

The fluid in the pinch discharge is considered to be perfectly conducting, nonviscous, but compressible. The characteristic equation governing the stability was derived. The displacement in the radial or r-direction of the plasma vacuum boundary away from its equilibrium position was used as an independent variable. The factor in the three-term difference equation was split into an infinite sum of fractions, suitable

for calculations, and each of which determines a possible mode of vibration in the r-direction, when the impressed radio frequency tends to infinity. The similarity to the Mathieu equation for the incompressible fluid is noted. Two new types of vibration, waves showing mainly either an Alfven or an acoustical character, are discussed. Stability boundaries of the first mode were determined. Alternating stable and unstable regions were found in the perturbations. The applications of the magnetohydrodynamic equations are mentioned. N.E.N.

N66-25423# United Kingdom Atomic Energy Authority Harwell (England). Metallurgy Div.
THE ROLE OF INCLUSIONS IN ARC INITIATION
J. T. Maskrey and R. A. Dugdale Dec. 1965 20 p refs
(AERE-R-5091)

This paper is concerned with the initiation mechanism of electric arcs in low pressure gas discharge apparatus. It is demonstrated experimentally that arcs are initiated at the sites of inclusions in the surfaces of metal cathode probes exposed to a hydrogen plasma. The presence of relatively volatile extraneous contamination is also necessary, however, for arc initiation to occur under the present experimental conditions (hydrogen ion current density 10A cm^{-2}, cathode field $10^5 V\ cm^{-1}$). A mechanism for arc initiation involving the production of bursts of cathodic vapour is postulated, in which an essential event is the dielectric breakdown of insulating inclusions. Author

N66-25448# Aktiebolaget Atomenergi, Stockholm (Sweden).
MEASUREMENT OF THE ELECTRICAL CONDUCTIVITY OF He^3 PLASMA INDUCED BY NEUTRON IRRADIATION
J. Braun and K. Nygaard Mar. 1966 42 p refs
(AE-218) CFSTI: HC $2.00/MF $0.50

The conductivity of a ^3He plasma created by the inelastic reaction with thermal neutrons $^3He + n_{th} \rightarrow {}^3He + p + 0.76$ MeV is studied as a function of neutron flux, gas temperature and gas density. Using reported values of the electron mobility the electron density is calculated from experimental conductivity values. Further, by accepting a reasonable value for the mean energy lost in creating one ion-pair, the recombination coefficient is estimated. The measurements performed so far cover temperatures between 300–1600°K and densities between 0.25–1 times the density at atmospheric pressure and 300°K. The neutron flux is varied between 10^{10}–10^{11} n $cm^{-2}s^{-1}$. As a sample of results achieved at 1600°K and the lowest density (corresponding to about atmospheric pressure) and the highest neutron flux the following values are obtained for the conductivity, the electron density and the recombination coefficient respectively: $\sigma = 0.2$ S·m^{-1}; $n_e = 6 \cdot 10^{11}$ cm^{-3}; and $\alpha = 2 \cdot 10^{-10}$ $cm^3\ s^{-1}$. An extrapolation of data obtained shows that the concept of neutron induced conductivity should be attractive for MHD power generation. Author

N66-25457# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A MODEL OF DISPERSIVE NON-LINEAR EQUATION
Nobuo Yajima, Akizi Outi, and Tosiya Taniuti Feb. 1966 26 p refs
(IPPJ-47) CFSTI: HC $2.00/MF $0.50

In this paper we consider a model of dispersive non-linear equation, which is derived from the Schrodinger equation by means of a non-linear transformation. The derivation is closely analogous to deriving the Burgers model from the diffusion equation. Then we obtain a solution resulting from an initial discontinuity, which corresponds to that of the Riemann's problem in the Burgers model. In the solution so obtained the limit that the Planck constant vanishes is discussed in comparison with the dissipative limit in the Burgers model which is realized by letting a dissipation constant tend to zero. It is shown explicitly that in these limits equations in the two models are the same, nevertheless their solutions are entirely different; for example, as is well known in the Burgers model one discontinuity develops from the initial discontinuity whilst in our model two discontinuities develop, across each of which the so-called generalized Rankine–Hugoniot relations are not valid. Author

N66-25472# Nagoya Univ. (Japan). Inst. of Plasma Physics.
TRANSMISSION AND ABSORPTION OF ELECTROMAGNETIC WAVES IN A COLLISIONLESS PLASMA SLAB
Ryo Sugihara Feb. 1966 32 p refs Submitted for Publication
(IPPJ-46) CFSTI: HC $2.00/MF $0.50

An investigation is made of the propagation of electromagnetic waves normal to a plasma slab having a density gradient. The plane of polarization of waves is perpendicular to an external magnetic field. At resonances, a WKB-type approximation does not represent waves, and an appreciable absorption appears due to infinitesimal collisions: the so-called resonance absorption. The transmission and absorption-coefficients are obtained in the limit of no collisions when in the slab the cut off is adjacent to the resonance. Author

N66-25476# Nagoya Univ. (Japan). Inst. of Plasma Physics.
STABILITY OF A UNIFORM PLASMA COMPOSED OF STREAMS IN THE ABSENCE OF AN EXTERNAL FIELD
Hiromu Momota Feb. 1966 32 p refs Submitted for Publication
(IPPJ-45) CFSTI: HC $2.00/MF $0.50

By means of the collisionless Boltzmann equation and the Maxwell equations with no external field, it is shown that a plasma composed of streams is necessarily unstable for a transverse oscillation propagating perpendicularly to the streams. The instability is attributed to the bunching of the electric current density, corresponding to the bunching of the charge density in the usual two-stream instability which is accompanied by the excitation of a longitudinal oscillation. When the thermal motion of the particles in a stream is taken into account, the instability can be suppressed due to the thermal diffusion of the bunched current. For a transverse oscillation, a criterion of the stability is obtained. Author

N66-25507# Northeastern Univ., Boston, Mass. Dept. of Electrical Engineering.
ON WAVE PROPAGATION IN A LINEARIZED, VERTICALLY INHOMOGENEOUS PARTIALLY IONIZED GAS: FORMULATION AND MATHEMATICAL METHODOLOGY Scientific Report No. 1
Harold R. Raemer 30 Sep. 1965 55 p refs
(Contract AF 19(628)-4325; ARPA Order 42)
(AFCRL-65-732; AD-629994) CFSTI: HC $5.60/MF $0.50

The problem of wave propagation in a linearized 3-component (electron, ion, neutral) gas is discussed for the case where the ambient gas parameters are arbitrary functions of the vertical coordinate in z and uniform with respect to time and the horizontal coordinates. The formulation of the problem from the Boltzmann equation to a system of simultaneous coupled linear algebraic and first order differential equations in z is discussed in some detail in the first part of the report. In the second part, mathematical methods of dealing with such systems are treated, culminating in a discussion of the numerical method finally chosen and the computer program used to obtain solutions. Author (TAB)

N66-25525# Institut Franco-Allemand de Recherches, St. Louis (France).

PHENOMENA PRODUCED BY HIGH VELOCITY SHOOTING OF SPHERES IN EXPLOSIVE GASES [PHANOMENE BEI HOCHGESCHWINDIGKEITSCHUSSEN MIT KUGELN IN KNALLGASGEMISCHE]

W. Struth, H. Behrens, and F. Wecken 27 Jul. 1964 50 p refs In GERMAN

(Contract T-453-J-206)

(ISL-T-22/64) CFSTI: HC $2.00/MF $0.50

Expansion of shock and detonation waves in a combustion channel is investigated in relation to the high velocity shooting of spheres into explosive gases. Oscillation frequencies and induction times are reported, as are various temperature estimations. Consideration is also given to the gas dynamics of the instability produced and the reaction kinetics.

Transl. by M.W.R.

N66-25528*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.

NONSYMMETRIC INFLATION OF A MAGNETIC DIPOLE

E. N. Parker Apr. 1966 39 p refs Submitted for Publication

(Grant NsG-96-60)

(NASA-CR-74869; EFINS-66-31) CFSTI: HC $2.00/MF $0.50 CSCL 20I

The basic theoretical properties of nonsymmetric inflation of a dipole magnetic field by ionized gas are pointed out. It is shown that the distortion ΔB of the field in the neighborhood of the dipole depends very much on whether there is a nonconducting layer present and on the configuration of the inflating gas, in contrast to symmetric inflation, in which ΔB depends only on the total energy of the inflating gas. Dissipation of the nonsymmetric portion of the inflating gas is rapid because nonsymmetric inflation drives $\nabla \times B$, or current, down along the magnetic lines of force and across the ionosphere. Dissipation is also rapid because of the nonsymmetric distortion of the field, whose pattern rotates with the azimuthal drift of the inflating gas. The high rate of dissipation implies that nonsymmetric inflation can probably be important only during the active phase of a magnetic storm. Author

N66-25586# Institut Franco-Allemand de Recherches, St. Louis (France).

MICROWAVE RESEARCH OF PLASMAS PRODUCED BY SHOCK WAVES AND GAS DETONATIONS [MIKROWELLE-NUNTERSUCHUNGEN AN STOSSWELLEN-UND GASDETONATIONS-PLASMEN]

H. Freiwald, B. Koch, H. W. Koch, and M. Konig 16 Mar. 1964 17 p refs In GERMAN

(ISL-T-9/64) CFSTI: HC $1.00/MF $0.50

Reflections of 3-cm microwave radiation on plasma shock waves produced with 10-cm hypersonic wave chamber and gas detonation in acetylene and hydrogen–oxygen mixtures were measured. The reflection coefficient as function of the shock Mach number and the absorption during transverse radiation of the plasma were determined. Longitudinal absorption during penetration of the detonation plasma was corroborated. K.W.

N66-25658# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).

CRYOSTAT FOR SOLID DEUTERIUM TARGETS [CRIOSTATO PER BERSAGLI DI DEUTERIO SOLIDO]

A. Cecchini and I. Modena 24 Jan. 1966 13 p refs In ITALIAN *Its* Nota Interna No. 303

(LNF-66/2) CFSTI: HC $1.00/MF $0.50

A method is cited for obtaining high temperature plasma by heating small particles at high density with the energy from a high powered pulsed laser. In order to avoid expansion due to the thermal velocity of the particles which renders the plasma transparent, the laser energy was varied experimentally by using lasers of 10 gigawatts and higher. Schematics and operational details of the cryostat constructed to solidify deuterium are presented. Temperature curves and the interaction of liquid helium and liquid nitrogen are indicated. It is stated that a sample of solid deuterium forms well at a temperature of 25°K. An enlarged photograph shows that in most cases the solid deuterium sample remained attached to the steel pin of the cryostat. Depending on the temperature of the pin, the sample remains attached for about 1 minute before falling. This phenomenon led to directing a pulsed laser at $\approx 10^{-8}$ sec on the solid deuterium target. The stable target, i.e., the deuterium sample adhering to the pin, eliminated the problem of a trigger for the cryostat and was used in experiments for high temperature plasma. Transl. by R. LI.

N66-25715*# National Aeronautics and Space Administration, Washington, D. C.

INTERACTION OF MOVING BODIES WITH A PLASMA (INTRODUCTORY REMARKS)

Ya. L. Al'pert *In its* Space Res. May 1966 p 317–321 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Plasma stability in a perturbed region is one of the theoretical problems related to the movement of spacecraft in rarefied atmospheres which requires the attention of researchers. A general discussion deals with the velocity of rapidly moving bodies, electron concentration and angular distributions, and related topics. M.W.R.

N66-25716*# National Aeronautics and Space Administration, Washington, D. C.

BRAKING OF BODIES MOVING IN A RAREFIED PLASMA

A. V. Gurevich and A. M. Moskalenko *In its* Space Res. May 1966 p 322–341 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Interaction of neutral particles with moving bodies, scattering probability, particle scattering on the body surface, and particle reflection from the surface are discussed in terms of braking a moving sphere. Braking force formulas are given for both rapidly and slowly moving bodies interacting with neutral particles. Braking force produced by the interaction of a body with charged plasma particles is also calculated, and the dependence of the braking force of a large rapidly moving body on the potential of the body is shown graphically. Consideration is also given to the braking of a small, spherical body whose radius is less than the Debye radius in a plasma; and both elastic scattering and ion recombination on a body surface are discussed. Interactions with incident ions and electrons and with reflected ions are described; and for the latter, the following topics are discussed: (1) elastic specular scattering of ions from the body surface, (2) specular and diffuse ion reflection and neutralization on the body surface, and (3) elastic diffuse ion reflection from the body surface. M.W.R.

N66-25717*# National Aeronautics and Space Administration, Washington, D. C.

ASYMPTOTIC FORM OF THE TRAIL OF A BODY MOVING IN A RAREFIED PLASMA

Yu. M. Panchenko *In its* Space Res. May 1966 p 342–354 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Disturbance in neutral particle and ion concentrations have been investigated in a sphere, a cylinder, and a body whose dimensions are much smaller than the Debye radius. The

asymptotic form of the trail behind a body moving in a rarefied plasma is indicated during the study of perturbations in the vicinity of a weakly-charged sphere or cylinder, as well as by the examination of a small body which is regarded as a point body. The angular function and other aspects of ion concentration for a point body are considered, and details are given for the necessary computations. M.W.R.

N66-25718*# National Aeronautics and Space Administration, Washington, D. C.

PERTURBED ZONE STRUCTURE IN THE VICINITY OF A CYLINDRICAL BODY IN A PLASMA

A. M. Moskalenko *In its* Space Res. May 1966 p 355–359 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

A kinetic theory is used to calculate the electric field and plasma perturbation in the vicinity of a charged, infinite cylinder whose radius is much greater than the Debye radius. Expressions are employed for the concentration of attracted and repulsed particles in a cylindrical potential field with a fully absorbent cylindrical surface; and the problem is reduced to integrating the Poisson equation for the field potential with specified boundary conditions. An equation, written in dimensionless variables, is solved by the iteration method. A formula is also given for the determination of electron flux per unit length of the cylinder surface. Boundary conditions are given for solutions of problems involving a double layer around the cylinder surface; and numerical integration of the resulting equation indicates a field potential dependence on distance. M.W.R.

N66-25766# Joint Publications Research Service, Washington, D. C.

FOURTH RIGA CONFERENCE ON MAGNETIC HYDRODYNAMICS

M. V. Filippov 2 Jul. 1965 10 p Transl. into ENGLISH from Magnitn. Gidrodinamika (Riga), no. 1, 1965 p 154–156 (JPRS-30926; TT-65-31425) CFSTI: $1.00

An overview is presented of the reports and other communications delivered at the fourth conference on Magnetic Hydrodynamics convened at Riga in June 1964. The three sections of the conference were concerned with (1) aspects of magnetohydrodynamic and shock waves in a plasma medium; (2) flow of electrically conductive channels and boundary layer problems; and (3) applied magnetic hydrodynamics. M.W.R.

N66-25793# United Kingdom Atomic Energy Authority, Culham (England).

EXPERIMENTAL OBSERVATIONS OF COLLISIONLESS SHOCK WAVES IN A MAGNETIZED PLASMA

J. W. M. Paul, M. J. Parkinson, J. Sheffield, and L. S. Holmes Nov. 1965 22 p refs (CLM-P92)

Electric and magnetic field measurements within the structure of a shock front are presented. The shock front propagates through a highly ionized plasma in a direction perpendicular to a magnetic field. The dynamics of the driving piston, a linear Z-pinch, and of the shock wave are shown to agree with theory. At low Alfven Mach number ($M_A > 3$) the structure measurements are consistent with a shock mechanism based on electron drift instabilities. This 'resistive' mechanism is theoretically inadequate for $M_A > 3$. The experimentally observed change of structure for $M_A \geq 3$ is interpreted as evidence for an additional, but as yet unidentified collisionless mechanism. Author

N66-25819# Japan Atomic Energy Research Inst., Ibaraki.

ION TEMPERATURE MEASUREMENT OF A STREAMING PLASMA BY MEANS OF A DOUBLE PROBE METHOD

Nobuki Kawashima Sep. 1965 12 p refs (JAERI-MEMO-2039) CFSTI: HC $1.00/MF $0.50

The effect of stream velocity on the Langmuir double probe characteristics and ion temperature determination in the plasma stream are discussed. When the probe was placed perpendicularly to the plasma stream, the current characteristic was found to be symmetric with respect to the applied voltage. The characteristic was asymmetric when the probe was parallel to the stream. Graphs of the data are included. The asymmetric case was considered in greater detail. The angle between the plasma stream and the line passing through the tips of the electrodes of the probe was measured, and the results are given in graph form. The decrease of the saturation current was observed only when the leeward electrode was just behind the windward electrode. The shadow effect of the windward electrode was calculated, and the ion temperature was determined for the low density plasma. It was suggested that this method can be applied to the ion temperature measurement in the ionsophere by high speed rockets. N.E.N.

N66-25832# California Univ., Berkeley. Electronics Research Lab.

PROPAGATION AND INSTABILITIES IN BOUNDED AND FINITE TEMPERATURE PLASMAS

Joel S. Jayson 22 Sep. 1965 124 p refs (Contract AF 33(615)-1078; Grants AF-AFOSR-139-65; NSF GP-2239) (Rept.-65-24; AD-630128) CFSTI: HC $12.60/MF $1.00

The quasi-static analysis is used to examine propagation and instabilities in plasmas in which both the transverse bounds and the temperature are important. Initially only longitudinal thermal velocity is assumed and two stream instabilities are studied. With the introduction of transverse temperature, instabilities resulting from temperature anisotropy are also studied. The full set of Maxwell's equations is utilized for an investigation of the effects of dispersion on the synchrotron radiation spectrum. The investigation of hot plasmas with finite boundaries was undertaken initially to explain the differences between phenomena found in experimental observations and those predicted by the cold plasma theory. Longitudinal temperature is added to the model and it is found that strong cyclotron wave damping and the absence of the cyclotron-cyclotron interactions in a two steam configuration are predicted by the theory. Introducing transverse temperature into the model, using the Boltzmann equation, instabilities arising from temperature anisotropy are investigated and it is found that, for a bi-Maxwellian distribution, for low values of k_z the plasma is stable. The investigation of finite plasmas with transverse temperature is pursued by consideration of a configuration in which a boundary layer region is included and the particle density decreases to zero through this region. Author (TAB)

N66-25866# Illinois Univ., Urbana. Gaseous Electronics Lab.

AN INVESTIGATION OF ELECTRONIC RECOMBINATION IN HELIUM AND ARGON AFTERGLOW PLASMAS BY MEANS OF LASER INTERFEROMETRIC MEASUREMENTS Scientific Report No. 2

M. A. Gusinow, J. B. Gerardo, and J. T. Verdeyen 15 Feb. 1966 118 p refs (Grant DA-ARO(D)-31-124-G582) (AROD-4832-7; AD-630074) CFSTI: HC $4.00/MF $0.75

Two helium-neon laser interferometers were used to obtain the electron and neutral atom densities in an afterglow plasma. The interferometric technique utilized allows one to

obtain both the spatial and temporal dependence of the electron decay. The two gases studied were helium and argon at 2–8 Torr and 0.3–0.8 Torr respectively. The electron density was in the range $2\times10^{13} < N_e < 10^{15} cm^{-3}$ and the electron temperature in the range $1000 < T_e < 7000°K$. The electron temperature was measured by comparing the relative atomic line intensities and by inference from the recombination coefficient. The electronic recombination in helium, argon, and helium–argon mixtures was found to follow closely the predictions of Bates, Kingston, and McWhirter for collisional-radiative recombination (Proc. Phys. Soc. 83:43, (1964)). In the range of electron temperature and density studied the recombination coefficient exhibited an approximate $T^{-9/2}$ dependence. The electron temperature inferred from the measured recombination coefficient indicates a pronounced electron temperature gradient across the tube which is believed to be due to electron heating effects in the afterglow. Author (TAB)

N66-25873# Hughes Research Labs., Malibu, Calif.
THE DIOCOTRON INSTABILITY IN PLASMAS AND GAS DISCHARGES
W. Knauer Mar. 1965 42 p refs Submitted for Publication
(RR-332; AD-477636)

The wave interaction underlying the diocotron effect is re-examined and a physical model of the instability presented. A wave analysis is then given for circular, wall-enclosed charge layers with finite length in the axial direction. Circular layers are of particular interest, since they apply to various plasma, discharge, and electron device geometries. Their instability behavior is found to be similar in many respects to the behavior of linear charge sheets, described in earlier work. In contrast to linear sheets, however, circular layers are unstable only when their thickness is sufficiently small. This effect is associated with the inability of charge perturbations to have a wavelength which exceeds the layer circumference. Data are presented for the magnitude of growth in various configurations and for the critical layer width at which growth terminates. Author (TAB)

N66-25905# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDYING CONDUCTIVITY OF PLASMA IN A TRANSVERSE MAGNETIC FIELD
A. V. Nedospasov and I. Ya. Shipuk 17 Nov. 1965 13 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur (USSR), v. 3, no. 2, 1965 p 186–191
(FTD-TT-65-1610/1+2+4; AD-624835) CFSTI: HC $1.00/MF $0.50

Two independent methods are used to investigate experimentally the dependence of the effective conductivity of plasma on the Larmor frequency of electrons. TAB

N66-25916# Minnesota Univ., Minneapolis. Plasma Physics Lab.
STUDY OF COLLISION PROCESSES IN GASEOUS PLASMAS Semiannual Technical Report
H. J. Oskam, ed. Jan. 1966 8 p
(Contract Nonr-710(37); Proj. Defender)
(SATR-5; AD-630123) CFSTI: HC $1.10/MF $0.50

The report summarizes the studies related to collision processes in gaseous plasmas during the period July 1965 to January 1966. During this period the papers, 'Afterglow Studies in Noble Gas–Hydrogen Mixtures,' (J. Appl. Phys. 36, 3740 (1965)) and 'Ion Mobilities in Helium,' (Phys. Rev. Letters 15, 1018 (1965)) were published and two papers ('Afterglow Studies in Helium'; 'A Technique for Simultaneously Measuring Ion Densities, Metastable Atom Densities and Light Emission in Decaying Gaseous Plasmas') were accepted for publication. Three papers were presented at the Eighteenth Gaseous Electronics Conference (October 1965, Minneapolis). Summaries are given of conclusions resulting from studies by means of the SLEAMA I system and the Mobility-Mass Identification Tube. Also discussed are modifications planned for the SLEAMA systems, and miscellaneous results. Author (TAB)

N66-25943# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
EXPERIMENTS ON WAVE INTERACTIONS BETWEEN PLASMA AND AN ELECTRON STREAM IN A MAGNETIC FIELD
J. R. Apel and A. M. Stone Oct. 1965 21 p refs Presented at the 7th Intern. Conf. on Phenomena in Ionized Gases, Belgrade, 22–27 Aug. 1965
(Contract NOw-62-0604-c)
(TG-746; AD-630040) CFSTI: HC $1.00/MF $0.50

Experiments have been conducted on the UHF wave interactions between a plasma and an electron stream, and comparisons made between the measured and calculated values of frequencies and wavelengths. The apparatus consists of a plasma column 1 cm in diameter with n_e adjustable between 10^9 power and 10^{13} power/cc; an electron gun yielding 180 ma at 2000 volts, flowing coaxially with the plasma; and a collimating magnetic field of 200 oersted intensity. The theory and measurements show the instability to be due to the interaction of the electron cyclotron wave in the plasma with the 'plasma wave' in the beam. Author (TAB)

N66-25969# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratorio Gas Ionizzati.
THE EXPERIMENT ON THE ELECTRICAL BREAKDOWN IN VACUUM AT LABORATORIO GAS IONIZZATI
C. Gourlan, Ch. Maisonnier, and M. Samuelli Nov. 1965 23 p refs
(LGI-65-30)

A review is made of the theories of breakdown in vacuum, and an experiment is described in which electron prebreakdown currents are prevented to reach the anode by means of a transverse magnetic field. (NSA)

N66-26003# Princeton Univ., N. J. Plasma Physics Lab.
TOROIDAL VACUUM FIELD WITH MINIMUM VARIATION OF $\int DL/B$
C. S. Gardner Dec. 1965 62 p refs
(Contract AT(30-1)-1238)
(MATT-391) CFSTI: HC $3.00/MF $0.75

The effectiveness of scallops or periodic bulges of the field in reducing the variation of the specific flux of a magnetic line across a toroidal tube is studied. NSA

N66-26013# Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Instituut voor Plasma-Fysica.
THE DIELECTRIC BEHAVIOUR OF A PLASMA AT CYCLOTRON RESONANCE
D. C. Schram Oct. 1965 14 p refs Supported by EURATOM and Nederlandse Organisatie voor Zuiver Wetenschappelijk Onderzoek *Its* Rept.-65-25
(NP-15782)

An expression for the dielectric tensor ϵ of a plasma in a static magnetic field and a circularly polarized standing electromagnetic field, transverse to the static field is obtained.

The relativistic mass increase is taken into account in the particle-motion equations leading to ϵ, so eliminating the singularity at cyclotron resonance ($\omega=\Omega$) appearing in the non-relativistic expression $\epsilon_\perp=\epsilon_0\ (1-\omega_p^2/(\omega^2-\omega\Omega))$. Also a few considerations about dissipation are given, indicating the importance of collisions and particle escape, particularly in high quality systems. Author (NSA)

N66-26017# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.

IONIZATION RATE AT HIGHER ELECTRON DENSITIES IN DC FIELDS MEASURED IN AN ELECTRODELESS DISCHARGE

H. Beerwald Nov. 1965 9 p refs Submitted for Publication
(JUL-322-PP)

A method of measuring the ionization rates of weakly ionized gases in DC electric fields at electron densities between 10^{11} and 10^{12} cm^{-3} is described in which the growth rate of the electron density is determined by microwave interferometry. Measurements on toroidal discharges in hydrogen and nitrogen are summarized. NSA

N66-26018# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.

PLASMA EFFECT IN AN IONIZED HELIUM LINE [PLASMA-EFFEKTE AN EINER IONISIERTEN HELIUMINIE]

H. F. Berg Aug. 1965 26 p refs In GERMAN Presented at The Plasma Phys. Comm. of the German Phys. Soc., Munich, 1965
(JUL-280-PP)

An attempt was made to observe a temperature- and/or density-dependent blue shift of the 4686-Å He II line. A T-tube was used as the plasma source, and the profiles were obtained in single shots using a multi-channel light guide apparatus. No shift was observed within the experimental accuracy of 0.3 Å. NSA

N66-26019# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.

IONIZATION OF HYDROGEN AND NITROGEN IN A UNIFORM MAGNETIC FIELD INCREASING WITH TIME

Hans Beerwald Nov. 1965 9 p refs Submitted for Publication
(JUL-327-PP; Conf-650836-2)

The temporal growth of electron density during the formation of ring discharges in damped oscillating strong magnetic fields was studied. Discharges of this type can be produced in magnetic fields, generated by the discharge of a capacitor bank. The electron density shows characteristic jumps each time when the magnetic field passes through zero. Near zero the magnetic field depends linearly on time. The study of ionization can be limited to these time intervals, since for the rest of the time ionization seems to be negligible. The multiplication of the electron density was measured in hydrogen and nitrogen by means of microwaves. A simplified interpretation of the results is given. Author

N66-26021# Laboratoire de Recherches sur la Physique des Plasmas, Lausanne (Switzerland).

THE ANOMALOUS SKIN EFFECT IN A PLASMA

E. S. Weibel Nov. 1965 30 p
(LRP-18-65)

A semi-infinite plasma with a sharp boundary and extending to infinity is treated. The form of the kernel depends on the type of reflection which the electrons suffer at the surface, and on the unperturbed velocity distribution. It is assumed that the electrons are specularly reflected. An arbitrary velocity distribution is assumed for the derivation of the principle equations. The problem is solved explicitly for a Maxwellian distribution using the Boltzmann equation with a relaxation term and Maxwell's equations without displacement current. NSA

N66-26062# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).

EFFECTS RELATED TO THE RADIAL ELECTRIC FIELD IN A Q-MACHINE

G. Grieger Mar. 1966 57 p refs
(IPP-2/46) CFSTI: HC $3.00/MF $0.75

In a Q-machine with end plates heated to a uniform temperature there must exist a radial electric field proportional to the gradient of the particle density, thus being a consequence of a deviation from the equilibrium case. This radial component of the electric field has an influence on the velocity distribution of the ions and leads—for a certain range of particle densities—to increased loss rates of ions. The calculations have been performed under the assumption of an electron sheath on the end plate and by taking into account the centrifugal forces acting on the ions. Author

N66-26076# International Centre for Theoretical Physics, Trieste (Italy).

ON CONSTANTS OF THE LINEARIZED MOTION OF VLASOV PLASMAS

O. De Barbieri and A. Nocentini Dec. 1965 38 p refs
(IC/65/90) CFSTI: HC $2.00/MF $0.50

This paper considers a one specie Vlasov plasma with an equilibrium distribution function spatially homogeneous, and uses a method, which requires no particular information on the equilibrium distribution function, to find the quadratic constant of its linearized motion, taking into account the full electromagnetic interaction. The coefficient equations of the quadratic constant of the motion are written and it is shown that the system of equations splits into two separate systems; one for the symmetric and one for the antisymmetric part of the coefficients. The symmetric system is examined and two sets of constants are found. The antisymmetric system is then studied followed by a comparison of the above mentioned method with an alternative. A particular case of an isotropic equilibrium distribution function is then considered. R.N.A.

N66-26123*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THE DETECTION OF THE PLASMA COMPONENT OF MAGNETOHYDRODYNAMIC WAVES IN SPACE

Marcia Neugebauer 12 Jun. 1962 32 p refs
(Contract NAS7-100)
(NASA-CR-74996; JPL-TM-33-93) CFSTI: HC $2.00/MF $0.50 CSCL 20I

The fundamental structure of low-frequency magnetohydrodynamic waves in interplanetary space is analyzed with respect to variations of the magnetic field, the plasma velocity, and the plasma density. The analyses have been conducted in order to (a) determine the time profile of such waves as seen by the types of plasma detectors presently used or planned for use in the direct measurement of the properties of the interplanetary plasma, and (b) aid in the design of second-generation detectors specifically suited to the analysis of magnetohydrodynamic waves in space. It is concluded that plasma detectors with flat resolution functions allow a reasonably faithful reproduction of the waveform of the plasma

motion, but that this type of instrument suffers from blind spots for the detection of some transverse hydromagnetic waves. The type of instrument with a peaked resolution function, on the other hand, is not troubled by blind spots but creates a large amount of distortion of the plasma waveform. It is possible, however, to determine fluid velocity and density of the plasma by simultaneously monitoring each member of a group of at least four plasma detectors of conventional design. Author

N66-26177# International Centre for Theoretical Physics, Trieste (Italy).
PLASMA WAVE PROPAGATION IN HOT INHOMOGENEOUS MEDIA
M. N. Rosenbluth, H. L. Berk, and R. N. Sudan 19 Jan. 1966 19 p refs Sponsored by AEC and Cornell Univ.
(IC/66/1)

Consideration is given to the propagation of electrostatic plasma waves in a system described by the one dimensional linear Vlasov equation in the presence of a slowly varying static potential. Expressions are derived which are more general than previous results, and the formal basis of the expansion for the Vlasov case is demonstrated. Fundamental equations for the system are: $df/dt \quad (x,v,t) = \partial f/\partial t + v(\partial f/\partial x) - \nabla\Phi(x)\partial f/\partial v = -(e/m)v\Sigma(x,t)\partial F(E)/\partial E$, and $\partial\Sigma/\partial t(x,t) + 4\pi i(x,t) = 0$, where f is the perturbed distribution function; F(E) is the equilibrium distribution function; x,v,t are the space, velocity, and time coordinates; $E = v^2/2 + \Phi(x)$ is the normalized particle energy; m/e $\Phi(x)$, the static potential, is taken as zero at $x = -\infty$ and increases monotonically with x; $\Sigma(x,t)$ is the perturbed electric field; and e and m are the particles' charge and mass. C.T.C.

N66-26254*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
LANDAU DAMPING AND DEBYE SHIELDING
Peter D. Noerdlinger [1966] 25 p refs
(Grant NsG-96-60)
(NASA-CR-75042; EFINS-66-45) CFSTI: HC $1.00/MF $0.50 CSCL 20I

A physical explanation in terms of competition between ion bunching and electron shielding is given for the dependence of the damping of longitudinal ion waves in a collisionless plasma on the electron–ion temperature ratio. The Debye shielding of an externally induced electrostatic perturbation of form exp $(ikx - i\omega_0 t)$ in a plasma is derived and discussed. The usual procedure of discussing the energetics of Landau damping in terms of only the damped part of the distribution function f is justified. Author

N66-26363# Stanford Univ., Calif. Mechanical Engineering Dept.
DIRECT ENERGY CONVERSION SYSTEMS. PART I: ELECTRICAL CONDUCTIVITY OF PARTIALLY IONIZED GASES Quarterly Technical Report, 1 Mar.–31 May 1965
S. Schweitzer and M. Mitchner 30 Sep. 1965 58 p refs Submitted for Publication
(Contract AF 49(638)-1123; ARPA Order 246)
(AFOSR-66-0225; AD-628528) CFSTI: HC $3.00/MF $0.50

A simplification of the Chapman–Enskog method for the calculation of the electrical conductivity of a multicomponent partially ionized gas in a magnetic field is presented. The calculation requires the inversion of a matrix which is of the order of the approximation, and is independent of the number of species. The third approximation to the electrical conductivity is examined for an electron-ion-neutral plasma and the results are compared with those obtained from the mixture rules of Lin, Resler, and Kantrowitz, and of Frost. It is shown that within the uncertainties in the experimental electron–neutral cross-section values, Frost's formula offers a satisfactory method of calculation for most engineering applications. Author (TAB)

N66-26373# AVCO-Everett Research Lab., Everett, Mass.
EXPERIMENTAL STUDIES OF STRONG HALL EFFECTS AND VXB INDUCED IONIZATION
J. Klepeis and R. J. Rosa Sep. 1964 37 p refs
(Contracts AF 04(694)-33; AF 04(694)-414)
(AVCO-Everett Res. Rept.-177; AD-606889) CFSTI: HC $2.00/MF $0.50

The document recounts studies performed during the last three years using a graphite inert gas heater, typical flow conditions being 100 gm/sec argon at one atmosphere pressure and 1800 to 2000° Kelvin seeded with 0.1 to 1% cesium vapor. The aim of work was primarily to study MHD channel and electrode performance at high values of $(\omega\tau)$ (5 to 15) and secondarily, to look for the occurrence of extra-thermal ionization. Many different channel and electrode configurations were tested. Straight segmented electrode channels did not perform well, apparently due to nonuniformity created by extra-thermal ionization over the electrode walls. Channel geometries in which the normal current closes upon itself performed much better and substantial enhancement of the power output due to V×B induced ionization was observed. The results correlate well with results obtained in applied electric fields and with theory when energy loss due to radiation is included. Author (TAB)

N66-26374# AVCO-Everett Research Lab., Everett, Mass.
AN EXPERIMENTAL AND THEORETICAL STUDY OF MHD IONIZING FRONTS
R. M. Patrick and E. R. Pugh Sep. 1964 38 p refs
(Contract AF 49(638)-1129)
(AVCO-Everett Res. Rept.-188; AD-606894) CFSTI: HC $2.00/MF $0.50

An experimental and theoretical description of ionization fronts propagating into hydrogen with a bias magnetic field in the plane of the front is presented. The experimental evidence showed that the absolute light intensity behind the front corresponds to a fully ionized plasma. The density ratio was obtained by measuring the magnitude of the current in the front, the front speed, and using the equation of mass and momentum. The front speeds are small compared to the Alfven velocity and are characterized by a critical velocity, i.e., the velocity a molecule must have so the kinetic energy equals the energy necessary to ionize it. A theory for the ionization front was developed which neglects the plasma pressure and abandons the condition E=V×B both ahead and behind the front. The theory predicts the front velocity and the rather unusual variation of the density ratio across the fronts with the front speed. Author (TAB)

N66-26395# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF HIGH-FREQUENCY INSTABILITIES ON A COLD CATHODE REFLEX DISCHARGE [CONTRIBUTION A L'ETUDE DES INSTABILITIES A HAUTE FREQUENCIES DANS LA DECHARGE REFLEX A CATHODES FROIDES]
Michel Gregoire (Ph.D. Thesis) 10 Jun. 1965 76 p refs In FRENCH
(CEA-R-2822)

The cold cathode reflex discharge develops a cathode sheath of several hundreds of volts, which accelerates electrons released from the cathode to high velocities along the lines of the axial magnetic field. On the studied pressure range (4×10^{-4} torr $<p<2\times10^{-2}$ torr) the plasma density is about $10^{11}cm^{-3}$. Under certain conditions high frequency (1–5000 MHz) instabilities appear. These instabilities are found to profoundly modify the mean characteristics of the discharge. In particular, particle flow across the lines of magnetic field is found to be considerably greater than that predicted by classical diffusion theory. Theoretical considerations are presented with complementary experimental results. They show that the high frequency instabilities are a result of the fast electronic assembly accelerated through the cathode sheath. Author (NSA)

N66-26402# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleares.

EXTENSION OF THE CHILD–LANGMUIR LAW TO A BEAM OF PARTICLES HAVING AN INITIAL VELOCITY [EXTENSION DE LA LOI DE CHILD–LANGMUIR A UN FAISCEAU DE PARTICULES ANIME D'UNE VITESSE DIREGEE]

Richard Geller Nov. 1965 24 p refs In FRENCH

(CEA-R-2898)

A d–c ion current of 50 mamp/cm^2 was obtained with approximately 100 volts extraction from the plasma created by the CIRCE device, and a still stronger electron current was obtained with a still lower extraction. These results are an order of magnitude higher than the ordinary characteristics. In the neutral plasma beam produced in the CIRCE device, the ions have mainly longitudinal energy whereas the electron energy is transverse. This situation makes the charge separation easier. This result is explained on a basis of current increase due to the initial velocity of the particles. Author (NSA)

N66-26404# Japan Atomic Energy Research Inst., Tokyo.

CURRENT DISTRIBUTION IN MHD HALL GENERATORS

Sakuro Matsunaga Sep. 1965 19 p refs

(JAERI-1093)

The distributions of the current and field in infinitely long ducts of linear Hall generators were analyzed from the method of conformal mapping under the following assumptions: the magnetic field, conductivity and flow velocity of the gas are independent of the position in the duct. The analysis was made for the case where the electrode length in the gas flow direction is equal to that of the insulator. The results of analysis are as follows. The geometrically opposed electrodes are not in equipotential. In order to make the electrodes in each pair the equipotential, the emitting electrodes must be shifted in the gas flow direction with respect to the anodes. The open circuit voltage of the generator becomes lower than the Hall electromotive force, because of the internal shorting through the boundary layer near the insulators. The shift length, open circuit voltage and internal conductivity of the generator were given as a function of the segment ratio ρ, voltage factor K and Hall parameter $\omega\tau$. Also, the loading characteristic of the generator is discussed with the variation of ρ and $\omega\tau$. The problem of duct end losses was not taken into consideration. Author (NSA)

N66-26455# California Univ., Livermore. Lawrence Radiation Lab.

A MONTE CARLO STUDY OF A ONE-COMPONENT PLASMA, I

S. G. Brush, H. L. Sahlin, and E. Teller 28 Sep. 1965 66 p refs

(Contract W-7405-ENG-48)

(UCRL-14467-T) CFSTI: HC $3.00/MF $0.75

A Monte Carlo study was made of a plasma of heavy ions immersed in a uniform neutralizing background. Systems containing from 32 to 500 particles, with periodic boundary conditions, were used. The results of the study are presented in terms of a dimensionless parameter $\Gamma=(4\pi n/3)^{1/3}[(Ze)^2/kT]$, where n is the ion density (particles per cubic centimeter), T is the temperature (°K), k is the Boltzmann constant, e is the electronic charge, and Z is the atomic number. Thermodynamic properties and pair distribution functions were obtained for values of Γ ranging from 0.05 to 100.0 from the canonical ensemble by the Monte Carlo (MC) method. Two different methods were used to determine the potential energy of a configuration. The first is the "minimum image convention" employed in many previous MC calculations. Each particle is allowed to interact only with each other particle in the basic cell, or with the nearest periodic image of each other particle if the image is closer. In the seond method, the interaction of a particle with all the images of the other particles is taken into account by a technique similar to the Ewald procedure used to calculate lattice sums. Energies, and values of the pair distribution function are compared with predictions of various approximate theories for small Γ values. NSA

N66-26467# California Univ., Berkeley. Lawrence Radiation Lab.

PLASMA KINETIC EQUATIONS

John C. Price (Ph.D. Thesis) 20 Dec. 1965 241 p refs

(Contract W-7405-ENG-48)

(UCRL-16631) CFSTI: HC $6.00/MF $2.25

A kinetic equation is derived for a homogeneous field free plasma. This equation effectively joins the theory for a stable system (the Lenard-Balescu equation) and that for an unstable system (the quasilinear equation), for it contains terms from each equation, plus a term rather similar to that of quasilinear theory, but depending only on the one particle distribution function. The derivation follows the formal method of Dupree, except that the collision term is evaluated for finite time, rather than the limit $t\to\infty$. The behavior of a large number of terms which appear to oscillate in time is obtained by analytic continuation of various integrals in a manner similar to that used by Landau. It is shown that the kinetic equation satisfies the conservation laws, leads to an H theorem, and correctly reduces to the Lenard–Balescu equation in the asymptotic (long time) limit. The equation is generalized to include the effect of a uniform magnetic field. In a different calculation a collision term is obtained valid to order $1/1n\Lambda$ for small amplitude waves in a uniform plasma. This result generalizes the ordinary Fokker–Planck equation from the domain $0 \leq \omega << \omega_p$, $0 \leq k << k_d$ to the domain $0 \leq \omega << \Lambda\omega_p$, $0 \leq k \lesssim k_d$. It is shown that the collisional correction to the behavior of small amplitude waves also appears in the description of fluctuations in a spatially uniform plasma. This correction applies to the kinetic equation described above, so that the collective effect arising from zeros of the dielectric function are affected by collisional damping as well as by Landau damping. Author (NSA)

N66-26485# Aktiebolaget Atomenergi, Stockholm (Sweden).

METHODS FOR THE DETERMINATION OF CURRENTS AND FIELDS IN STEADY TWO-DIMENSIONAL MHD FLOW WITH TENSOR CONDUCTIVITY

E. A. Witalis Dec. 1965 14 p refs Submitted for Publication

(AE-210)

Rigorous derivations are given of the basic equations and methods available for the analysis of transverse MHD flow when Hall currents are not suppressed. The gas flow is taken to be incompressible and viscous with uniform tensor conductivity and arbitrary magnetic Reynolds's number. The magnetic field is perpendicular to the flow and has variable strength. Analytical solutions can be obtained either in terms of the induced magnetic field or from two types of electric potential. The relevant set of suitable simplifications, restrictive conditions, and boundary-value considerations for each method is given. Author (NSA)

N66-26500# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH-FREQUENCY OSCILLATIONS RESULTING FROM THE INTERACTION OF AN ELECTRON BEAM WITH PLASMA
A. K. Berezin, Ya. B. Faynberg, L. I. Bolotin, and G. P. Berezina 20 Jan. 1966 24 p refs Transl. into ENGLISH from Atomnaya Energ. (Moscow), v. 18, no. 1, 1965 p 5–14
(FTD-TT-65-1455/1+2+4; AD-629349) CFSTI: HC $2.00/MF $0.50

Results are given of experiments on the detection and study of oscillations developed in a beam and plasma produced as the result of their interaction. The experiments were conducted under conditions where the electron Langmuir frequency of the plasma, was less than the electron cyclotron frequency. The conditions of wave excitation in the beam and plasma, their frequency spectra, phase velocities, amplification factors, electrical field intensity, and absolute values and spectral distribution of excited oscillation power are determined. Experimental results from measurement of frequencies, amplification factors and phase velocities of excited oscillations in the plasma are in satisfactory agreement with calculated data. Author (TAB)

N66-26509# RCA Victor Co., Ltd., Montreal (Quebec). Research Labs.
MEASUREMENTS OF ANISOTROPIC PLASMAS USING A TURNSTILE MULTIPLE PROBE POLARIMETER Scientific Report No. 2
Morrel P. Bachynski, Freleigh J. F. Osborne, and Brian W. Gibbs Oct. 1965 31 p refs *Its* Rept.-7-801-42
(Contract AF 19(628)-4071)
(AFCRL-66-17; AD-630143) CFSTI: HC $2.00/MF $0.50

A turnstile multiple probe polarimeter was designed for plasma diagnostics at microwave frequencies. With the polarimeter it is possible to simultaneously measure the amplitude and phase of the space quadrature components of an electromagnetic wave of arbitrary polarization. This technique is thus well-suited for determining the properties of time varying or steady state anisotropic plasma. Measurements were conducted at a frequency of 9.2 Gc on a helium afterglow in a magnetic field using both linearly polarized and circularly polarized incident plane waves. The agreement of these experiments with theory indicate that the multiple probe polarimeter can be a reliable tool for plasma measurements. Author (TAB)

N66-26557# Space Sciences, Inc., Waltham, Mass.
INVESTIGATION OF CATHODE PHENOMENA IN THE MERCURY ARC Final Report, Jul. 1964–Aug. 1965
S. B. Afshartous, S. Aisenberg, V. Rohatgi, and C. G. Smith Griffiss AFB, N.Y., RADC, Feb. 1966 147 p refs
(Contract AF 30(602)-3093)
(RADC-TDR-66-12; AD-629869) CFSTI: HC $4.00/MF $1.00

An experimental and analytical study is made of the emission mechanisms of the mercury arc and it is concluded that the cathode spot temperatures are too low to operate predominately by thermionic emission. Various physical processes to reduce work function are discussed, and shown to be probably not significant. An emission model involving ion microfield emission is proposed and shown to be feasible. The related problem of retrograde arc motion is studied and a model involving plasma growth into large magnetic field regions is proposed. The retrograde arc speed is measured as a function of magnetic field and arc current. The variation of spot size with arc current, magnetic field, and vapor pressure is measured and is compared with a theoretical model based upon low pressure energy balance considerations. Spectrographic measurements show the absence of continuum radiation from the Mo notch cathode and absence of Mo spectral lines. This suggests that the refractory cathode spot operates at low pressures with little electrode evaporation for the conditions studied. The increase of arc voltage with magnetic field was measured and was interpreted as being predominately due to the cathode sheath. Author (TAB)

N66-26585# Illinois Univ., Urbana. Gaseous Electronics Lab.
ATOMIC DENSITY MEASUREMENTS IN NITROGEN, OXYGEN, AND HYDROGEN AFTERGLOW PLASMAS Scientific Report No. 3
Ewen A. Mc Lennan and L. Goldstein Feb. 1966 93 p refs
(Contract AF 19(628)-3307)
(AFCRL-66-88; AD-629924) CFSTI: HC $3.00/MF $0.75

Densities of ground-state N, O and H atoms, formed by dissociation of the parent molecular gases in dc and rf discharges, were measured over the range 10^{10} to 10^{16}/cc. Sensitive and unambiguous measurements that did not disturb the system under study were made by electron spin resonance (ESR) and atomic resonance absorption spectroscopy. Quantitative measurements were made by calibration of the atomic ESR resonance lines against an O_2 ESR resonance line standard. Densities determined by ESR and by gas titration agreed within 20 percent. Densities of ground-state atoms were investigated in the afterglows of pulsed and continuous rf discharges, and pulsed dc discharges, in both stationary and flowing gases. Dissociation of the parent molecular gas was found to be a strong function of the type of discharge and of the gas impurity content: rf discharges in gases with a few tenths per cent H_2O impurity typically produced four orders of magnitude more atoms than did pulsed dc discharges in 'pure' gases. Atomic densities were measurable up to 10 sec in rf discharge afterglows. The slow recombination of the atoms provides a long-lived energy source throughout the afterglow. Experiments were performed to show that the concentration of N atoms in the afterglow of a pulsed dc discharge in N_2 markedly affects the electron density, temperature, and collision frequency. TAB

N66-26610# Air Force Cambridge Research Labs., Bedford, Mass. Microwave Physics Lab.
THE NONLINEAR CONDUCTIVITY OF A WEAKLY IONIZED, NON-MAXWELLIAN MAGNETOPLASMA
Richard E. Haskell and Robert J. Papa Feb. 1966 26 p refs *Its* Phys. Sci. Res. Papers No. 191
(AFCRL-66-81; AD-630811) CFSTI: HC $2.00/MF $0.50

The a–c conductivity of a weakly ionized plasma can be calculated by making a spherical harmonic expansion of the electron velocity distribution function. This conductivity determines the propagation characteristics of rf waves in the plasma. If the plasma is immersed in a d–c magnetic field, the isotropic part of the distribution function depends upon the polarization of the rf wave; that is, it depends upon how the electromagnetic energy is divided among the right and left circularly polarized modes and the longitudinal mode. When

the magnetic field is reduced to zero, the function reduces to the form first derived by Margenau. A closed form expression for the function can be obtained for the case of a constant electron mean free path. A nonlinear conductivity tensor can be derived in which each component is a function of the polarization of the local rf field. Curves of the conductivity tensor components in the principal coordinate system as a function of the energy in the right and left circular modes are presented for propagation along the magnetic field.
Author (TAB)

N66-26686# Army Electronics Labs., Fort Monmouth, N. J. Electronic Components Lab.
CARBINO-PME EFFECT AS A POSSIBLE TOOL FOR MICROELECTRONIC MATERIALS EVALUATION: THEORY
Herbert Mette Feb. 1966 23 p refs
(ECOM-2652; AD-629608) CFSTI: HC $1.00/MF $0.50

A method for contactless determination of semiconductor parameters, such as minority carrier mobility or surface recombination velocity, has been theoretically explored and appears to be applicable for the evaluation of very thin and fragile materials as well as small size chips used in microelectronic technology. The effect investigated consists of focusing a sharp light beam on a piece of semiconductor material which is suspended in a magnetic field and measuring the torque caused by the circular flow of photoelectrons. This is called the Corbino-PMC (photomagnetoelectric) effect, analogous to the Corbino–Hall and Corbino–Nernst effects, and the general diffusion equations that govern the case have been solved for special boundary conditions. A graphic presentation of the results is presented for various light spot diameters and surface recombination velocities, and numerical examples are discussed. Author (TAB)

N66-26697*# Chicago Univ., Ill. Enrico Fermi Institute for Nuclear Studies.
UNSTABLE MAGNETOSONIC WAVES IN A RELATIVISTIC PLASMA
I. Lerche [1966] 25 p refs
(Grant NsG-96-60)
(NASA-CR-75027; EFINS-66-43) CFSTI: HC $1.00/MF $0.50 CSCL 20I

Linearized equations are set up to describe the effect of a circularly polarized electromagnetic wave on a plasma composed of thermal electrons and protons and also containing an anisotropic relativistic proton component. The unperturbed composite plasma is taken to be embedded in a homogeneous, uniform magnetic field and the wave is taken to propagate along the unperturbed magnetic field. For wave frequencies very much less than the electron cyclotron frequency it is shown that the relativistic proton plasma will be unstable provided only that $P_{||} > P_{\perp}$ where $P_{||}$ and $P_{\perp}$ denote the relativistic plasma pressure parallel and perpendicular to the ambient magnetic field respectively. The minimum e-folding time is estimated and upon inserting numerical parameters appropriate to the cosmic ray gas in the galactic disc it is shown that parallel anisotropy will be destroyed in a time short compared to the mean lifetime of cosmic rays in the disc ($\sim 6 \times 10^6$ years). Author

N66-26698*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
ATOMIC PROCESSES IN PLASMAS
T. D. Wilkerson Oct. 1965 34 p refs
(Grants NsG-283; NsG-359)
(NASA-CR-75078; BN-407) CFSTI: HC $2.00/MF $0.50 CSCL 20I

Experimental plasma physics deals both with atomic and collective processes, i.e., with two- and three-body interactions of particles and photons vs. many-body interactions over distances of order a Debye length or cyclotron radius. Measurment of atomic radiation and collision coefficients which are improtant in stellar atmospheres, dilute plasmas in space, and high temperature plasmas on earth are studied. Radiative transition probabilities will be measured for spectral lines of several light elements; e.g., CI, CII, Si, SII, NaI, AI, AII, between 2000 and 12,000 Å. Other elements and shorter wavelengths will follow this initial program. The spectroscopic source is a gas-driven shock tube which operates up to 15,000°K with at least 100 microseconds of steady conditions behind the reflected shock. Particular attention has been paid to direct measurement of the gas properties, rather than relying on shock wave theory alone. Data are presented on excitation temperature measured by the line-reversal technique. The flash lamp and fibre-optics employed for this and other purposes are also described. Author

N66-26717# Sperry Rand Research Center, Sudbury, Mass.
ELECTRON THERMAL DIFFUSIVITY IN RARE-GAS AFTERGLOW PLASMAS
Kaare J. Nygaard Nov. 1965 43 p refs *Its* Sci. Rept.-3
(Contract AF 19(628)-4183)
(SRRC-RR-65-96; AFCRL-65-842; AD-625082) CFSTI: HC $2.00/MF $0.50

This paper describes an experimental investigation of the electron thermal diffusivity D_T in room-temperature afterglow plasmas in neon and helium. The measurements were made in the absence of a magnetic field and covered an electron density range from 10^9–10^{12} cm^{-3}. The principle of the experiment was to heat the electrons selectively by a short microwave pulse, and then observe electron temperature transients at different locations within the plasma. The electron temperatures were determined by taking advantage of the temperature sensitivity of the electroacoustic Tonks–Dattner resonances. For electron-ion collision frequencies much larger than the electron-neutral collision frequency, the experimental data for D_T are inversely proportional to the electron density, and agree closely with the transport theory of Spitzer and Harm. In the limit of the weakly ionized plasma, the electron thermal diffusivity is independent of electron density, which is also in agreement with theory.
Author (TAB)

N66-26741# Nagoya Univ. (Japan). Inst. of Plasma Physics.
[ACTIVITIES OF THE INSTITUTE OF PLASMA PHYSICS] Annual Review, Apr. 1964–Mar. 1965
[1965] 94 p refs
CFSTI: HC $3.00/MF $0.75

The facility and the equipment of the research institute and the experiments being conducted are described. The satisfactory macroscopic stabilization of the PIG discharge, the installation of the rf heating section and plasma dressing section, and the commencement of experiments on the QP machine are reported. The progress in construction of multistage adiabatic compression and equi-temperature irreversible expansion devices, and theoretical magnetohydrodynamic studies connected with them are given. The design and construction of the heliotron device is mentioned. Fundamental experiments in plasmas are discussed, including plasma generation and plasma diagnoses probe measurements. N.E.N.

N66-26751*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
GENERALIZED LANDAU KINETIC EQUATION DESCRIBING THE TRANSVERSE DIFFUSION OF A NONGYROTROPIC PLASMA COLUMN
Michael J. Haggerty Mar. 1966 27 p refs
(Grant NsG-695)
(NASA-CR-75194; BN-443) CFSTI: HC $2.00/MF $0.50
CSCL 20H

Some further preliminary results are reported on the application of the plasma kinetic theory of Prigogine and Balescu to a plasma column in a uniform magnetic field. A relatively simple kinetic equation for the one particle distribution function is obtained. The resulting augmented kinetic theory is expected to describe a greater variety of diffusion phenomena. A multicomponent plasma is considered, but the effect of the macroscopic transverse electric field (due to charge separation) on the local interactions has not yet been calculated. The plasma is assumed to be homogeneous in the direction of the magnetic field, but an arbitrary inhomogeneity across the field is allowed. A collision integral due to Eleonskii, Zyryanov, and Silin can be reproduced as a special case. Contact is also made with the recent work by Sundaresan on the homogeneous nongyrotropic plasma. A method of properly including collective effects is suggested. Author

N66-26770# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
POWER DENSITY OF AN MHD-GENERATOR CONSIDERING HALF-EFFECT AND ION-SLIP [LEISTUNG EINES MHD-GENERATORS UNTER BERUCKSICHTIGUNG VON HALL-EFFEKT UND IONENSCHLUPF]
W. Ohlendorf Mar. 1966 35 p In GERMAN; ENGLISH summary
(IPP-3/37) CFSTI: HC $2.00/MF $0.50

From the theory for MHD-generators, the power-output of the usual generator-types has been calculated for the two cases of constant and variable conductivity, taking into account Hall-effect and ion-slip. Author

N66-26773# Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany).
PARTICLE LOSSES IN A WEAKLY IONIZED STATIONARY DC PLASMA IN A TOROIDAL MAGNETIC FIELD [LADUNGSTRAGERVERLUSTE IN EINEM SCHWACHIONISIERTEN STATIONAREN GLEICHSTROMPLASMA IM TOROIDALEN MAGNETFELD]
F. Karger Dec. 1965 66 p refs In GERMAN; ENGLISH summary
(MPI-PAE/PI-21/65) CFSTI: HC $3.00/MF $0.75

For the particle losses of a weakly ionized plasma which result from the torus-drift in the curved magnetic field, an expression is derived which is valid for certain parameters of the positive column of a gas discharge. To check this theory the "AMBIPOL" device was built; with this device it was possible to measure simultaneously the losses both in the toroidal and in the linear magnetic field by measuring the longitudinal electric field strength. As theory predicts, a weaker decrease of the longitudinal electric field was observed in the toroidal part of the discharge as compared to the linear part. The measured values of the relative electric field strength, however, exceed the theoretical limit, although the measurements of the electric field in the straight part and the measurements of the particle density and of the electron temperature in the curved part are consistent with theory. Moreover, contrary to the expectations, the onset of the KADOMTSEV instability occurs at lower critical magnetic fields in the toroidal part than in the straight part. Seven explanations are discussed. Author

N66-26782# Royal Inst. of Tech., Stockholm (Sweden).
EXPERIMENT ON A HIGH-CURRENT DISCHARGE AT ATMOSPHERIC PRESSURE
Erik A. Smars 31 Mar. 1965 41 p refs *Its* Arkiv för Fysik, Vol. 29, No. 9
CFSTI: HC $2.00/MF $0.50

A gas discharge between two plane electrodes initially at atmospheric pressure is studied. The current rises at about 10^{11} Å/sec to a peak value of about 10^5 Å. Most observations are made in hydrogen gas, some in helium, and a few in nitrogen. Special attention is paid to the initial phase. A thin channel in the gas is preionized by a vortex-stabilized dc arc in the 1 Å range. Streak and Kerr-cell camera pictures show that the following heavy discharge depends very much on the state of the preionized path. If this path is sufficiently narrow the main discharge contracts by magnetic pinching and is turned into a helix by the spiral (m=1) instability. The exponential growth rate is of the order $3\times10^7\,\mathrm{sec}^{-1}$ and agrees with pinch instability theory. Time resolved spectra show that the hot plasma is free from impurities during the first half cycle (2 μsec). Relative intensities of spectral lines from *O* V and *O* VI (0.7 per cent CO_2 added to the gas) indicate a temperature near $1.6\times10^{5\circ}$K at maximum contraction, when the current is 10–30 kÅ. The particle density has then increased to 10^{25}–10^{26} m^{-3}. Author

N66-26783# Princeton Univ., N. J. Plasma Physics Lab.
TALK ON ROADBLOCKS IN THE PATH OF CONTROLLED FUSION
A. S. Bishop Jan. 1966 35 p refs Presented at West Coast Conf. on the Am. Inst. of Elec. and Electron. Engr., San Francisco, 24 Aug. 1965
(Contract AT(30-1)-1238)
(MATT-412) CFSTI: HC $2.00/MF $0.50

A survey of the various approaches to controlled fusion is presented. Some of the more important recent developments in the US program are outlined, together with the difficulties encountered in each approach. NSA

N66-26784# Princeton Univ., N. J. Plasma Physics Lab.
MULTI-PROBE MEASUREMENTS OF FLUCTUATING AZIMUTHAL DENSITY VARIATIONS
K. Bol and K. Prelec Dec. 1965 27 p refs
(Contract AT(30-1)-1238)
(MATT-402) CFSTI: HC $1.00/MF $0.50

The evolution of azimuthal density fluctuations in the Etude Stellarator was studied by surrounding the plasma column with a ring of probes. Very rapid changes in the amplitudes of large-scale perturbations were observed, indicating kink instabilities. NSA

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N66-25454# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
TRANSMISSION ELECTRON MICROSCOPY OF NEUTRON-IRRADIATED α-Al_2O_3 SINGLE CRYSTALS
R. S. Wilks, J. A. Desport, and R. Bradley Dec. 1965 34 p refs
(AERE-R-5103)

The irradiation-induced macroscopic growth of α-Al_2O_3, which is anisotropic, depends on the integrated neutron flux and the irradiation temperature. As part of a programme to determine the cause of this growth, α-Al_2O_3 single crystals irradiated to various doses in the range 5×10^{19} to 4×10^{20} nvt$\geq$1 MeV at 150,650 and 1,000°C, respectively, have been examined by transmission electron microscopy; damage has been observed in the form of defect clusters, dislocation loops, dislocation tangles, stacking faults and cavities. The effect on this damage of post-irradiation annealing at temperatures up to 1800°C has been studied. The nature of the damage, before and after post-irradiation annealing, is compared with that observed in neutron-irradiated BeO and MgO.
Author

N66-25502# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.
MEASUREMENTS OF PHOTOCONDUCTION ABOVE MONOCRYSTALS MIXED WITH CdS [MISURE DI FOTOCONDUZIONE SU MONOCRISTALLI DROGATI DI CdS]
L. Bartolini 3 Feb. 1966 14 p refs In ITALIAN *Its* Nota Interna No.-304
(LNF-66/3) CFSTI: HC $1.00/MF $0.50

The technique used to dope semiconductor cadmium sulfide monocrystals with copper and silver is discussed. Also reported are the results of the influence of heat treatment of sulfur and selenium vapor samples on resistivity, spectral photo response, and quenching spectra. Some obvious dynamic effects exciting the samples by two component monochromatic light beams are described. Details are presented graphically on the preparation and doping of samples, and on the quenching process. Transl. by R. Ll.

N66-25671# Pennsylvania Univ., Philadelphia. Dept. of Physics.
[SPIN DYNAMICS IN FERROMAGNETIC AND ANTIFERROMAGNETIC MATERIALS] Annual Summary Report
Herbert Callen Dec. 1965 14 p refs
(Contract Nonr-551(36))
(AD-626746) CFSTI: HC $1.00/MF $0.50

Work in progress on the following is summarized: Angular correlation of nuclear spins in ferromagnets; magnon–phonon coupling near the Curie temperature; spin impurities in antiferromagnets (AD-624 721); Wick's theorem and diagrammatic expansions for spin systems (AD-624 720). Listings are also given of the technical reports that were distributed and the publications that appeared during the year. TAB

N66-25791# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
THE LINEAR ZEEMAN EFFECT IN CRYSTALS
K. H. Hellwege Sep. 1965 13 p refs Transl. into ENGLISH from Z. Physik (Berlin), v. 127, 1950 p 513–521
(AERE-TRANS-1045) HMSO: 1s 9d

Bethe's theoretical discussion of the Zeeman effect in crystals, based on a special case, is resumed and extended to all 32 point-symmetry classes. It appears that a linear Zeeman effect is observable in specifiable cases not only in the case of magnetic fields with parallel orientation to the crystallographic major axis, but also with perpendicular orientation.
Author

N66-25864# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GUNN EFFECT IN COMPOUND SEMICONDUCTORS
Arthur G. Foyt, Jr. 7 Jul. 1965 54 p refs
(Contract AF 19(628)-5167)
(TR-385; ESD-TDR-65-306; AD-630194) CFSTI: HC $3.00/MF $0.50

A theoretical and experimental study of the Gunn effect is presented. It appears that this effect, originally observed by Gunn as a time variation in the current through ohmic samples of n-GaAs when the sample voltage exceeded a critical value, can be accounted for by the transferred electron model of Ridley and Watkins. This model is based on a transfer of electrons from a low-mass, high-mobility conduction band that is lowest in energy to a higher-mass, low-mobility band as the electron temperature is increased by the applied electric field. If the transfer occurs rapidly enough as the electric field is increased, a bulk differential negative resistance will be realized, which then leads to the formation of domains of different electrical conductivity which move through the sample, giving rise to a time-varying current. The Gunn effect was also observed in n-CdTe, and resistance vs hydrostatic pressure experiments show that the transferred electron model is a reasonable explanation for this material as well. Finally, the absence of an instability in n-InSb and n-InAs is shown to be consistent with the transferred electron model. Author (TAB)

N66-25877# Illinois Univ., Urbana. Dept. of Physics.
THE MOSSBAUER EFFECT IN SURFACE STUDIES, FE^{57} ON Ag
Robert Paul Godwin (Ph.D. Thesis) Feb. 1966 103 p refs
(Contract AF 49(638)-1048)
(AD-479910)

The Mossbauer effect for atoms located at crystal surfaces is discussed. We show that the Einstein model is valid for describing qualitatively the mean square displacement of lattice atoms. The mean square displacement (Mossbauer recoilless fraction) and mean square velocity (Mossbauer second-order Doppler shift) of atoms in one and three-dimensional crystals with free surfaces are treated in a many-body approach. The simple models indicate that at high temperatures surface atom mean square displacements are on the order of twice bulk atom mean square displacements (or equivalently that surface atom Debye temperatures are about 1/square root of 2 times the corresponding bulk values) and that surface effects penetrate only a few atomic spacings into a crystal. A possible temperature dependence of the Mossbauer isomer shift due to anharmonic binding forces at surfaces is pointed out. The experimental difficulties faced in a surface Mossbauer study performed under ultrahigh vacuum conditions and the apparatus used in an attempt to overcome them are described. Mossbauer spectra of Fe(57) on LiF, in Ag, and on Ag have been obtained in the temperature range 100 to 400°K. Author (TAB)

N66-25936# Naval Ordnance Lab., White Oak, Md.
MAGNETOSTRICTION IN SINGLE CRYSTAL TERBIUM
Bernard F. De Savage Feb. 1966 69 p refs
(NOLTR-65-179; AD-630451) CFSTI: HC $6.60/MF $0.75

The temperature and magnetic field dependence of the magnetostriction of single crystal terbium metal was measured in the paramagnetic range from 230 to 370°K in fields H up to 25 koe. The magnetostriction is found to vary as H squares over the temperature range within which the magnetic moment is linear with H. The magnetostriction is found to follow the temperature dependence as predicted by the one-ion theory of Callen and Callen. The strains were measured along particular crystallographic directions so as to permit an evaluation of the four 1=2 coefficients described by Callen and

Callen. The magnitudes of the magnetostrictive strains are in order of magnitude and sign agreement with the atomic theory of Tsuya, Clark, and Bozorth. Author (TAB)

N66-25977# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies

ON SURFACE SUPERCONDUCTIVITY IN THE SUBCRITICAL REGION

Kazumi Maki Nov. 1964 13 p refs Submitted for Publication

(Contract AT(11-1)-264)

(EFINS-64-59; COO-264-224) CFSTI: HC $1.00/MF $0.50

As a simple application of the general Ginzburg-Landau equation previously deduced, surface superconductivity in a strong magnetic field is considered. The expression of local density of state and surface impedance is obtained. Also the critical current in superconducting sheath is calculated by using Abrikosov's procedure. Author (NSA)

N66-25982# IIT Research Inst., Chicago, Ill.

MAGNETIC PROPERTIES OF INSULATORS Quarterly Report, 16 May–15 Aug. 1965

Gordon A. Noble 10 Dec. 1965 48 p refs

(Contract AT(11-1)-578)

(IITRI-1184-18; COO-578-18) CFSTI: HC $2.00/MF $0.50

The optical absorption constant of the F-center is due to induced transitions. The luminescence is caused by spontaneous transitions between a different set of states. The interaction of the F-center with light is reviewed in order to obtain comparable quantum mechanical transition rates. The observed absorption includes a factor proportional to the frequency. The emitted power per unit energy interval is proportional to the fourth power of frequency. This has significant effects if one compares functions of the equilibrium ionic positions in the relaxed ground state and the relaxed excited state. The correction to the observed peak, width, symmetry and moments is calculated by formula and by numerical methods for absorption and emission of rubidium chloride. The former analytical approximation seems to be preferable. The distribution of expectation values for the operator seems to be wider and more symmetrical than the observed bands at low temperature. The corrections to the emission half width are very significant. Comparable quantities related to the second moment are not appreciably changed. The correct effective frequency is obtained from the uncorrected half widths. The density matrix formalism is applied to the saturation of an inhomogeneously broadened electron paramagnetic resonance line. The sequential saturation, delay and observation technique are analyzed. A set of conditions for the validity of the spin packet model are pointed out. The theory has observable significance when applied to the burning of a hole in a portion of the F-center resonance spectrum at 4°K. Previous models have not adequately explained the depth of the steady state hole as a function of the saturating power.

Author (NSA)

N66-26008# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

ON REVEALING OF DEFECTS IN SILICON P-I-N DETECTORS [O VYYAVLENII DEFEKTOV V KREMNIEVYKH P-I-N DETEKTORAKH YADERNYKH IZLUCHENII]

L. G. Yuskeselieva 8 Dec. 1965 14 p refs

(JINR-P-2489)

Defects in P–N junction of silicon P-I-N detectors are investigated by means of electrophotography and electrochemical depositing of copper. The study of the defects is associated with electric characteristics of detectors.

Author (NSA)

N66-26045# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

NUMERICAL SOLUTIONS OF THE SUPERCONDUCTIVITY EQUATIONS FOR ODD-A NUCLEI IN THE RARE-EARTH REGION

M. Y. M. Hassan, Z. Skladanowski, and Z. Szymanski Feb. 1965 37 p refs

(INR-602/VII/PH)

Numerical solutions of the equations of superconductivity are tabulated for even-odd nuclei in the rare-earth region. Some values of parameters for odd-A nuclei in this region are also given. Author (NSA)

N66-26052# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.

PRESENT STATE OF TECHNIQUES OF CONSTRUCTING SUPERCONDUCTING MAGNETS [STATO ATTUALE DELLE TECNICHE DI COSTRUZIONE DI MAGNETI SUPERCONDUTTORI]

G. Pasotti, N. Sacchetti, G. Sacerdoti, and G. Sanna 11 Mar. 1966 18 p refs In ITALIAN *Its* Nota Interna No. 312 (LNF-66/13) CFSTI: HC $1.00/MF $0.50

Manufacturing techniques for high current density superconductors using liquid helium, a material which maintains superconduction in the presence of a high magnetic field, are discussed. Superconductor magnetic tape or wire of niobium, zirconium, and vanadium alloys are reported to be the most suitable for industrial applications, according to laboratory tests conducted. Graphs show the critical current as a function of the magnetic field applied with wires of various vanadium and gallium alloys, and superconductor instability at various current densities. The first commercially available material for superconduction, Nb–Zr, is described; its training phenomenon in relation to degradation of the current surrounding the wire coils is mentioned. Tables report mechanical characteristics and transverse magnetic field at 80 kg for some superconducting materials. Diameters of large superconduction magnets, constructed since 1963, are also presented graphically. Transl. by R. Li.

N66-26259*# West Virginia Univ., Morgantown. Dept. of Physics.

THE PARAMAGNETIC SUSCEPTIBILITY OF LITHIUM AND SODIUM METAL Final Report

W. E. Vehse [1963] 19 p refs

(Grant NsG-533)

(NASA-CR-74966) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Using a spin resonance technique, the paramagnetic contribution of the conduction electrons to the total susceptibility of metallic sodium has been isolated and measured at 4°K. A Robinson NMR spectrometer was used to make these measurements. The results are in excellent agreement with measurements at 20° K and 77° K. The precision is not yet high enough to rule out a change in the susceptibility as the cause of a Knight shift anomaly at low temperatures however. Author

N66-26341# Air Force Cambridge Research Labs., Bedford, Mass. Optical Physics Lab.

THERMALLY INDUCED EFFECTS IN SOLID STATE LASER RODS

Richard Lee Townsend, Jr. Jan. 1966 45 p refs *Its* Phys. Sci. Res. Paper No. 188
(AFCRL-66-57; AD-630608) CFSTI: HC $4.60/MF $0.50

An experiment was performed to measure changes in optical length of ruby and neodymium in glass laser rods both during and after excitation by the pump flash. A Twyman–Green interferometer was used to produce fringes, the fringe movement being correlated with changes in optical length. Movement and distortion of fringes was observed using a multiframe image converter camera. The results show that all rods expand linearly with time during the time the pump is on and that all rods develop a distortion which is dependent on the radial energy density distribution within the rod. After the pump goes off the rods begin a relaxation back to the unexcited state. The relaxation is interrupted when hot air propagates from the flash tube to the rod causing the rod to reheat and causing an extremely concave appearance. The rods then relax slowly to an equilibrium state with ruby reaching this state in much shorter times (0.4 sec) then glass due to its higher thermal conductivity. These results stress the importance of uniform pumping if low beam divergence is to be achieved. Immersion of the rod in an index-matching infrared-absorbing fluid would be desirable not only to pump the laser uniformly but also to shield it from the infrared radiation which causes concave distortions after 20 msec. Author (TAB)

N66-26384# Rensselaer Polytechnic Inst., Troy, N. Y.
INVESTIGATION OF TRANSIENT RADIATION DAMAGE IN SEMICONDUCTOR MATERIALS Final Report, 1 Feb. 1963–30 Sep. 1965
Roland M. Lichtenstein, H. James Willard, Jr., John C. Corelli, Arthur R. Frederickson, and James W. Westhead Mar. 1966 46 p refs
(Contract DA-36-039-AMC-02165(E))
(AD-630701) CFSTI: HC $2.00/MF $0.50

A contactless method was developed for measuring induced photoconductivity in silicon. The method was used to search for transient radiation damage effects in silicon specimens irradiated by short bursts of high energy electrons. The investigation showed that transient radiation damage in silicon at room temperature is a minor effect when compared with permanent damage if the damage is assessed by way of the decay time of induced photoconductivity. No transient damage (as opposed to permanent damage) survives to 1.3 milliseconds after the instant when the damage is produced. Transient radiation damage experiments indicate that in p-type silicon the transient Hall and conductivity voltages decay in about 20–50 microseconds. Relatively long saturation times (about 10 to 100 microseconds) are observed in the transient Hall and conductivity voltage following an electron burst. The saturation time decreases with dose accumulation and also decreases as the irradiation temperature of the sample is decreased. Very similar effects also are observed in n-type silicon samples. In both n- and p-type silicon the Hall and conductivity voltages decay with about the same time constant. TAB

N66-26389# Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh.
PARAMAGNETIC RESONANCE SPECTRUM OF CO^{1+} IN SINGLE CRYSTALS OF CALCIUM OXIDE
W. Low (Hebrew Univ.) and J. T. Suss Oct. 1965 7 p refs
(IA-1056)

The paramagnetic resonance spectrum of Co^+ in CaO was investigated. Co^+ was obtained by γ irradiation of crystals containing Co^{2+}. The resonance results are: A = $(31.6 \pm 0.3) \times 10^{-4} cm^{-1}$; g = 2.2743 ±0.0008 at 20° K and g = 2.2756 ±0.0008 at 12° K. A comparison of effective core polarization between Co^+ in MgO, Co^+ in CaO and Ni^{2+} in MgO is given. Author (NSA)

N66-26436# TEM-Pres Research, Inc., State College, Pa.
LIGHT SCATTERING TECHNIQUES FOR CRYSTAL EVALUATION Final Report, 1 Jul.–31 Dec. 1965
V. Vand, E. A. Margerum, F. Schwab, and R. I. Harker 31 Jan. 1966 111 p refs
(Contract AF 19(628)-5213)
(AFCRL-66-119; AD-631041) CFSTI: HC $4.00/MF $0.75

The work described in this report has resulted in (1) the development of the theory of light scattering by various crystal imperfections, (2) the production of computer programs for the calculation of light scattering functions, (3) the computer tabulation of specific values for scattering factors or amplitude functions, intensity functions and Mie coefficients as a function of various selected angles of scattering from 0 to 180 degrees and various sizes of spherical voids from 10 to 10,000 A radius, (4) specific tables of the functions of pi and tau occurring in Mie's theory for light scattering calculations, and (5) an engineering design of an optical system utilizing a continuous laser for observing, evaluating, recording and determining the arrangement of defects in crystals.
Author (TAB)

N66-26538# Army Foreign Science and Technology Center, Washington, D. C.
FERRITE MATERIAL FOR CENTIMETER WAVELENGTHS
I. I. Sil'vestrovich, B. A. Pavel'yev, S. A. Nazarova-Shilkina, and V. M. Mkrtch'yan Dec. 1965 4 p Transl. into ENGLISH from Byul. Izobreteniy i Tovarnykh Znakov (USSR), no. 12, 1964
(FSTC-381-T65-593; AD-626046) CFSTI: HC $1.00/MF $0.50

The subject of the invention is a ferrite material for the centimeter-wave band on the basis of an Mg–Cr system. In order to decrease magnetic losses, it consists of (in mol .%): MgO 40=1.5; Fe_2O_3 40=1.5; Cr_2O_3 20=1.5. $MnCO_3$ 0.01 =0.005 mol.%; V_2O_5 1.0=0.5% by weight is added when manufacturing large-sized parts from the material.
Author (TAB)

N66-26558# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics.
MAGNETIC PROPERTIES USING THE MOSSBAUER EFFECT Final Report
Peter Hillman et al Feb. 1965 94 p refs
(Contract AF 61(052)-621)
(AD-615646) CFSTI: HC $3.00/MF $0.75

The structure and decomposition of wustite $Fe_{1-x}O$ have been studied by Mossbauer, magnetic and X-ray techniques. The antiferromagnetic Curie temperature of hematite (alpha-Fe_2O_3 has been determined to be about 685°C from Mossbauer measurements. The Mossbauer efficiency of krypton in a cloth-rate compound is constant at about 20% in the range 150°–300° K, and increases rapidly at lower temperatures. This behavior is not consistent with any static potential.
Author (TAB)

N66-26563# Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh.
OPTICAL AND ELECTRICAL PROPERTIES OF DIAMOND Annual Summary Report No. 2, 1 Nov. 1964–31 Oct. 1965
A Halperin [1965] 11 p refs
(Contract AF 61(052)-759)
(AFCRL-66-213; AD-631044) CFSTI: HC $1.60/MF $0.50

THERMOLUMINESCENCE OF SEMICONDUCTING AND INSULATING DIAMONDS: Glow curves showed peaks near 150° and 250°K. Blue thermoluminescence could be excited by wavelengths up to 0.4 micron. Red-emitting glow peaks were found at 175° and 290°K that could be excited up to about 0.6 micron. DARK CURRENT AND PHOTOCONDUCTIVITY IN SEMICONDUCTING DIAMOND: Direction of rectification between 80° and 373°K indicated p-type conductivity. ELECTROLUMINESCENCE (EL) OF SEMICONDUCTING DIAMONDS: At low temperature the emission spectrum was mainly blue, the red becoming comparatively stronger at higher temperature. Plots of the log of the EL brightness vs 1/square root of V gave 2 straight lines differing in slope, with higher slope at higher voltages. EL was observed with voltages smaller than the 5.5-ev band gap. THEORETICAL INVESTIGATIONS: Kinetics of luminescence were investigated when electrons are excited to the conduction band before falling to a center and when transition is through a discrete excited state. TAB

N66-26565# Emmanuel Coll., Boston, Mass.
MEASUREMENT OF THE LIFETIME OF MINORITY CURRENT CARRIERS IN Ge AND Si BY OBSERVING THE PHOTOCONDUCTIVE DECAY OF THE SPREADING RESISTANCE UNDER A POINT CONTACT
Wei-hwa Zhuang and Gui-sheng Pan Bedford, Mass., AFCRL, Feb. 1966 25 p refs Transl. into ENGLISH from Wu Li Hsueh Pao (Peking), v. 19, no. 3, 1963 p 191–201
(Contract AF 19(628)-5073)
(EMM-65-16; TT-66-61014; AD-631102) CFSTI: HC $1.00/MF $0.50

The paper presents a study of the photoconductive decay of the spreading resistance of Ge and Si under various exciting lights and surface conditions. The influence of the surface recombination velocity and exciting light on the shape of the decay curve is also studied, and a simple method is described for testing the volume lifetime. TAB

N66-26591# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
INVESTIGATION OF ULTRA HIGH VACUUM SPUTTERED THIN FILMS Final Report, 1 Nov. 1963–31 Oct. 1965
George Wallis, Sumner P. Wolsky, and Ernest E. Pittelli 30 Nov. 1965 47 p refs
(Contract AF 19(628)-3840)
(AFCRL-65-891; AD-626443) CFSTI: HC $2.00/MF $0.50

The structural and electrical characteristics of low pressure sputtered germanium films deposited on amorphous and single crystal substrates were investigated. The very low deposition rates of the experiments provided an opportunity to examine film growth as a function of the important parameters which influence it. The results of the investigation on amorphous quartz substrates have been presented in the paper entitled 'Low Pressure Sputtered Germanium Films'—J. Vac. Sci. and Tech. 2, 97 (1965). The most recent work concerned with insulating single crystal substrates is presented in the report. Preliminary investigations were made of the structural and electrical characteristics of silicon films sputtered under similar conditions as those used for germanium. The major factor of interest uncovered in this limited investigation concerned the apparently greater mobility of the deposited silicon atom on self substrates as compared to sapphire substrates. Author (TAB)

N66-26596# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
HIGH PRESSURE RESEARCH
Richard Zallen Aug. 1965 14 p
(Contract Nonr-1866(10))
(PR-36; AD-626734) CFSTI: HC $1.00/MF $0.50

Work is summarized on the following topics: Optical and electrical properties of the lead salts under pressure; Electrical properties of gray tin as a function of pressure; Effect of pressure on reflectivity spectra; Spin resonance measurements on semiconductors; Properties of the transition metal oxides; Ratio type spectrometer for the measurement of small increments in absorption coefficients; Semiconducting properties of forsterite; Faraday rotation in semiconductors; Optical properties of semiconductor thin films; Band structure of gallium antimonide; Infrared shift of the emission of lead salt diodes with pressure. TAB

N66-26602# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
PROJECT DEFENDER Final Technical Report, 1 Jun. 1963–1 Jun. 1965
Nicolaas Bloembergen Feb. 1966 40 p refs
(Contract Nonr-1866(49); ARPA Order 455)
(AD-630452) CFSTI: HC $2.00/MF $0.50

Experimental work on the second harmonic production of light in reflection from semiconductors and on the stimulated Raman effect in liquids is reviewed. Five published articles, partially supported under this contract, are reproduced as appendices. Author (TAB)

N66-26650*# Hawaii Univ., Honolulu. Dept. of Physics and Astronomy.
ON VACUUM UV STUDY OF SOLIDS Status Report No. 7, Nov. 1–Apr. 30, 1966
William Pong and K. Watanabe [1966] 8 p ref
(Grant NsG-328)
(NASA-CR-75109) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Brief descriptions of continued research on electron emission and vacuum ultraviolet radiation are given. Spectral quantum yield measurements on evaporated layers of cuprous halides, made over the photon energy range of 10 to 23 eV, show that the yield reaches a plateau which extends from about 12 eV to the limit of the measurements. Backward photoemission yield of evaporated thin films was measured as a function of thickness for potassium bromide, tellurium, and aluminum. The results indicated that the attenuation lengths of the photoexcited electrons are approximately 180, 60, and 20 Å respectively. Photoemission yield and optical density measurements on evaporated layers of mixed system KCl-KBr, and photoionization yield measurements on nitric oxide in the photon energy range from 10 to 21 eV are mentioned. N.E.N.

N66-26695*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
COMPUTER-AIDED ELECTRONIC CIRCUIT DESIGN, PART I. CONDUCTION PROCESSES IN THIN FILMS, PART II. Status Report, 1 Jun.–30 Nov. 1965
Dec. 1965 39 p refs
(Grant NsG-496; MIT Proj. DSR-9948)
(NASA-CR-75033; ESL-SR-256) CFSTI: HC $2.00/MF $0.50 CSCL 20K

Part I relates to a research program in electronic-circuit design through use of on-line time-shared computers. Several developments pertaining to computer programs designated as CIRCAL are described. These developments reflect the current effort to expand and diversify the programs in order to permit handling of a wide variety of network types and configurations.

Also presented is a progress report on a separate computer-programming effort pertaining to simulation of nonlinear networks in time-shared computers. Part II is a status report on research in thin-film conduction processes. As stated in preceding status reports, this work is motivated by a desire to understand better the mechanisms by which conduction takes place in thin semi-insulating films and between sandwich layers of these films. Some items of work which have been in process for almost a year have culminated in either a technical paper or a report. Abstracts of these publications are presented. Continuing research in a thin-film coincident-frequency memory concept is summarized. Author

N66-26736# Industrial Science and Technology Agency, Tokyo (Japan).
IMPURITY CONDUCTION IN n-TYPE GERMANIUM
Chikako Yamanouchi Feb. 1965 47 p refs In JAPANESE; ENGLISH summary *Its* Res. of the Electrotech. Lab. No. 656
CFSTI: HC $2.00/MF $0.50

Measurements of the resistivity and Hall coefficient of n-type germanium single crystals containing from 2×10^{16} to 1×10^{17} antimony atoms/cc and those containing from 2.3×10^{17} to 3.9×10^{17} arsenic atoms/cc have been made below 4.2°K. Magnetic field strengths up to 20 $\kappa\phi$ have been employed. These samples belong to the hopping or the intermediate region of the impurity conduction and the temperature dependence of the resistivity obeys an exponential law, $\rho\infty\exp(\Sigma/\kappa T)$. The main effect of the magnetic field is an increase of the pre-exponential factor $\rho\infty$ for the hopping samples while it is an increase of the activation energy Σ for the intermediate ones. The increase of Σ is proportional to H^2 and the proportionality coefficient depends on donor concentration, compensation ratio, and also slightly on temperature. An impurity band model which can qualitatively explain these features of intermediate impurity conduction is proposed. Author

N66-26831# Nebraska Univ., Lincoln.
A LITERATURE SURVEY ON INTERFACES, THIN DIELECTRIC FILMS AND SURFACES—1965
N. M. Bashara [1965] 23 p refs Submitted for Publication
(Contract Nonr-3718(01))
(AD-631187) CFSTI: HC $1.00/MF $0.50

A survey is given of the significant literature on dielectric films and related phenomena to be published in the annual 'Digest of the Literature on Dielectrics,' National Academy of Sciences—National Research Council. Author (TAB)

N66-26865# National Bureau of Standards, Washington, D. C.
SURVEY OF MAGNETIC THIN FILM MATERIALS
George William Reimherr 25 Sep. 1964 60 p refs
(NBS-TN-247) GPO: $0.40

This survey lists some of the properties, interesting features, and proposed applications of the various magnetic thin film materials. Research activity with the lesser mentioned magnetic film materials is included. About 200 references are cited. Author

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N66-25608# Utah Univ., Salt Lake City. Dept. of Chemical Engineering.
COMBUSTION IRREGULARITIES IN SOLID PROPELLANTS Final Report, Aug. 1962–Aug. 1963
Norman W. Ryan 4 Mar. 1966 11 p refs
(Grant AF-AFOSR-451-62; ARPA Order 317-62)
(AFOSR-66-0606; AD-630409) CFSTI: HC $1.60/MF $0.50

In studies employing the side-vented end-burner, the participation of the solid phase in acoustic oscillations was quantitatively confirmed and described. In cooperation with other laboratories, the usefulness of the burner for propellant evaluation was demonstrated. Initial experiments in a study of non-acoustic instability were performed. Author (TAB)

N66-25836# Coating and Chemical Lab., Aberdeen Proving Ground, Md.
SHELF STABILITY AND INHIBITING ABILITY OF GUM PREVENTIVE, GASOLINE Final Report
Jules B. Counts Mar. 1966 25 p refs
(CCL-194; AD-630416) CFSTI: HC $1.00/MF $0.50

The object was to evaluate the shelf stability and inhibiting ability of gum preventive compound meeting Federal Specification VV-G-800. Varying amounts of gum preventive compounds were added to combat gasoline and regular motor fuel and stored at ambient temperature in order to determine its inhibiting ability. The shelf stability of the concentrated gum preventive packaged in containers of various types and capacities was determined at 72° and 110°F. Storage test results show that the gasoline gum preventive has satisfactory inhibiting ability and shelf stability for a minimum of 24 months. Four ounce screw top, tin lined type cans, sufficient for a single application is considered to be the best packaging medium for this compound. Author (TAB)

N66-25876# Picatinny Arsenal, Dover, N. J. Feltman Research Labs.
STANDARD LABORATORY PROCEDURES FOR DETERMINING SENSITIVITY, BRISANCE, AND STABILITY OF EXPLOSIVES
Arthur J. Clear Dec. 1965 68 p refs Revision of FRL-TR-25, Jan. 1961
(PA-TR-3278; FRL-TR-25; AD-476513)

The detailed procedures for standard laboratory tests to determine the sensitivity, brisance, and stability of high explosives, primers, pyrotechnic compositions, and propellants have been reviewed and revised to bring the methods up to date. Accordingly, the directions for some of the procedures have been modified wherever necessary to include details which have been found to be important. The 240-hour hydrolysis test has been deleted. Methods for determining decomposition temperature, electrostatic sensitivity, and high temperature vacuum stability have been added. Author (TAB)

N66-26376# Western Co. of North America, Dallas, Tex. Research Div.
RAPID GELLING OF AIRCRAFT FUEL Final Report
Arthur R. Schleicher Feb. 1966 34 p ref
(Contract DA-44-177-AMC-112(T))
(USAAVLABS-TR-65-18; AD-624765) CFSTI: HC $2.00/MF $0.50

Experimental evidence has shown that the severity of accidential hydrocarbon fuel fires can be reduced by chemically solidifying the liquid fuel. The purpose of the subject work was to determine the feasibility of utilizing this principle to reduce the dangers of postcrash aircraft fires. The feasibility

of rapidly gelling large quantities of aircraft fuel has been investigated and established. The types and quantities of chemical gelling agents required were investigated. The times required for the gelling of 50-gallon quantities of fuel have been determined. Mechanisms and power sources for mixing gelling agents with fuel have been evaluated. The hazards and penalties associated with these systems have been established. Impact tests were made to determine the reduction of fire hazard with gelled fuel under dynamic conditions. These tests showed radical differences in performance between gels which behave similarly under static tests. Soap type and amine-isocyanate gels have about equal effectiveness in reducing fire hazards in small scale experiments. The performance of the soap system was decidedly superior in terms of achieving rapid gelling of large quantities of fuel. Author (TAB)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N66-25514# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LOSSES IN STAGE OF AXIAL TURBINE AT SPEEDS OF APPROACHING IN THE VICINITY OF THE SPEED OF SOUND
J. Camek and O. Bunata 18 Feb. 1966 24 p refs Transl. into ENGLISH from Zpravod. Vyzkumny a Zkusebni Letecky Ustav (Czech.), no. 6, 1963 p 9-15
(FTD-TT-65-1846/1+2+4; AD-630284) CFSTI: HC $2.60/MF $0.50

To reduce the weight and complexity, individual stages of avia gas turbines are planned for speeds of sound. The effectiveness of stages should not decrease here. The causes are discussed of loss increases in blade rims at these velocities and mentioned are the requirements, which must be observed during the planning of blades. From the measurement results of dividing blade lattices are visual the difficulties, with which the preparation of blade lattices encounters with low losses when flowing at sonic speed and also given are ways for their elimination. Author (TAB)

N66-25544*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
FEASIBILITY ASSESSMENT OF A SOLID PROPELLANT ELECTRIC THRUSTER (SPET) Final Report
15 Mar. 1966 271 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951102)
(NASA-CR-74953; Doc.-66SD4255) CFSTI: HC $6.00/MF $1.00 CSCL 21C

Feasibility analysis of a Solid Propellant Electric Thrustor (SPET) operation indicates that a low density detonation can be initiated and sustained in a constrained range of temperatures and pressures. It is found that SPET presents no unique interface problems with a typical spacecraft. A SPET-A system, which did not utilize optimum electromagnetic induction (EMI) techniques, was EMI tested according to standard practices. Most of the noise generated was attributed to the electronics themselves rather than to the plasma formation and propagation. It is concluded that SPET can be brought within acceptable EMI specification limits by conventional suppression techniques. M.W.R.

N66-25585*# Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Operations.
SUMMARY OF OBSERVED RESULTS WHEN CHILLING THE M-1 FUEL TURBOPUMP TO LIQUID HYDROGEN TEMPERATURE
J. A. Ritter 3 Jun. 1966 80 p refs
(Contract NAS3-2555)
(NASA-CR-54828; AGC-8800-65) CFSTI: HC $3.00/MF $0.75 CSCL 21H

Test procedures, instrumentation, and results are presented for the chilldown of the M-1 rocket engine fuel turbopump assembly with liquid hydrogen. The only insulation applied to the turbopump was on the pump end bearing coolant lines and the return lines from the downstream side of the thrust balance piston to the transition stage. Among the conclusions are: facility and instrument operation were satisfactory; in one test, the bearings were chilled from ambient temperature to −418°F in 0.9 hour with a liquid hydrogen flow rate of 29 gal/min; component warpage or distortion was negligible; no geysering action was noted in the pump suction line; and turbopump shaft rotation was eliminated by control of chilldown flow rates. No significant changes in design are considered necessary. N.E.N.

N66-25815# Netherlands Research Centre TNO for Shipbuilding and Navigation, Amsterdam. Engineering Dept.
COMPARATIVE SHIPBOARD MEASUREMENTS OF SURFACE TEMPERATURES AND SURFACE CORROSION IN AIR COOLED AND WATER COOLED TURBINE OUTLET CASINGS OF EXHAUST DRIVEN MARINE DIESEL ENGINE TURBOCHARGERS [VERGELIJKENDE METINGEN VAN CORROSIE EN WANDTEMPERATUREN IN LUCHT- EN WATERGEKOELDE TURBINEUITLAATHUIZEN VAN DRUK-VULGROEPEN VOOR SCHEEPSMOTOREN]
R. W. Stuart Mitchell and V. A. Ogale Dec. 1965 14 p ref /ts Rept.-77M
(TDCK-44575) CFSTI: HC $1.00/MF $0.50

This report deals with comparative surface temperature and surface corrosion measurements on the turbine outlet casings of an air cooled and of a water cooled exhaust driven turbocharger of a marine diesel engine using residual fuel. Results indicate that, for the turbocharger under investigation, air cooling is to be preferred to water cooling. Author

N66-25826# RAND Corp., Santa Monica, Calif.
AIRCRAFT TURBINE ENGINES: DEVELOPMENT AND PROCUREMENT COST
A. Frank Watts Nov. 1965 83 p
(Contract AF 49(638)-66-C-0001; Proj. RAND)
(RM-4670-PR(Abridged); AD-624094) CFSTI: HC $3.00/MF $0.75

An examination of the development and procurement cost of aircraft turbine engines. The results are based on the history of 14 engines costing approximately $8 billion. Engine size and quantity in addition to institutional and environmental influences bear on the cost estimates. This study is intended primarily for those involved in long-range planning exercises on manned military aircraft employing air-breathing engines. Author (TAB)

N66-26273*# Hughes Research Labs., Malibu, Calif.
ION THRUSTOR ELECTRODE SURFACE PHYSICS STUDIES Summary Report
R. G. Wilson [1965] 626 p refs With suppl.
(Contract NAS3-6278)
(NASA-CR-54680; HRL-6278-SR) CFSTI: HC $9.26/MF $3.00 CSCL 21C

Vacuum work functions, cesiated electron emission S curves, cesium ion emission curves, critical temperature envelopes, and cesium ion desorption energies are reported for 25 surfaces. Theoretical expressions and computer calculations are reported for composite surface work functions, cesium atom and ion desorption energies, residence times, and surface diffusions coefficients. Author

N66-26283*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE EFFECT OF INJECTOR DESIGN ON THRUST-CHAMBER EROSION
R. W. Rowley and W. H. Tyler 1 Mar. 1966 25 p refs
(Contract NAS7-100)
(NASA-CR-75153; JPL-TR-30-750) CFSTI: HC $1.00/MF $0.50 CSCL 21H

Results are presented for an experimental investigation of the relationship between injector design and the erosion of ablative and pyrolytic graphite thrust-chamber throats. Techniques used to determine spray properties and local heat flux are described. It is concluded that injector spray properties, including local mass and mixture-ratio distributions, significantly influence throat erosion, and that proper control of these spray properties can reduce such erosion without recourse to separate film-cooling orifices. Four injectors, each incorporating 10 unlike-impinging-doublet elements, were tested with N_2O_4–N_2H_4 propellants at the 100-lb thrust level. Three different arrangements of the elements were used, one of which demonstrated substantially lower erosion of both ablative and pyrolytic graphite materials. Although changing the spray configuration in the boundary flow reduced erosion of the ablative material, the relationship between spray properties and heat transfer or ablation has not been clearly defined. Author

N66-26329# Thiokol Chemical Corp., Elkton, Md.
AN EXPERIMENTAL INVESTIGATION OF SOME OF THE ACOUSTIC ATTENUATION SOURCES IN THE TE-M-388 (IROQUOIS) ROCKET MOTOR Scientific Report No. 2, Feb. 1965–Jan. 1966
John W. Edwards and John Mallick 25 Feb. 1966 55 p refs
(Contract AF 19(628)-4068)
(E37-66; AFCRL-66-178; AD-630920) CFSTI: HC $5.60/MF $0.50

A series of experiments was performed in a TE-M-388 motor to determine the acoustic attenuation resulting from the propellant, the headcap, and the igniter. Several different headcap and igniter configurations were evaluated to determine the effect of such changes. A shock tube technique was used to generate an acoustic pulse in a simulated rocket motor; the amplitude of consecutive reflections of the acoustic wave was measured, and the acoustic absorption coefficient was calculated for each configuration. A supplemental series of experiments was performed to determine the complex storage and loss shear modulus for the TE-M-388 propellant, TP-H-3317. The test results showed that the use of a potting compound 'energy damper' in the headcap had a significant detrimental effect on the gross attenuation. The energy absorbed by the propellant appeared to be insignificant and there were no significant differences in the attenuating characteristics of the various igniters. Author (TAB)

N66-26548*# California Univ., Berkeley. Space Sciences Lab.
INVESTIGATION OF KILOVOLT ION SPUTTERING Quarterly Progress Report, Feb.–Apr. 1966
Harold P. Smith, Jr., F. C. Hurlbut, and T. H. Pigford 30 Apr. 1966 29 p refs *Its* Ser. 7, Issue 22
(Contract NAS3-5743)
(NASA-CR-54907) CFSTI: HC $2.00/MF $0.50 CSCL 21C

Progress is reported in the investigation of the sputtering of single crystals of suitable electrode material under cesium and mercury ion beam bombardment. Initial results from the studies of the mercury ion beam indicate that the beam composition at the entrance to the magnet chamber consists of Hg^+ and Hg^{++} ions only. The ratio of Hg^+/Hg^{++} can be controlled from greater than 200 down to approximately 10 by varying the arc voltage from 30 to 100 V. At the target position, the energy distribution of the Hg^+ beam was determined by a retarding potential method for an 8.0 KeV beam. For this beam, $\Delta E/E_0$ was approximately 3%. It was found that from 70% to greater than 99% of the ion beam hit the target within a radius of three millimeters. Initial results of studies in related areas are also reported, including: surface density measurements of oxygen atoms on an aluminum substrate; determinations of the angular distribution of sputtered aluminum atoms; sputtered atom energy measurements; penetration of cesium ions under near saturation conditions by electrolytic stripping of an irradiated target; and cesium sputtering of molybdenum. Tables which summarize the data obtained are included. H.W.S.

N66-26655*# Catholic Univ. of America, Washington, D. C.
DYNAMICS OF SOLID PROPELLANT ROCKET MOTORS Final Report
Apr. 1966 32 p refs
(Grant NsG-125-61)
(NASA-CR-75120) CFSTI: HC $2.00/MF $0.50 CSCL 21H

Abstracts of technical reports are presented, along with additional notes, for an experimental and theoretical investigation of solid propellant rocket engine dynamics. The experimental phase was primarily concerned with the development of an apparatus to measure the complex shear modulus of linear viscoelastic materials, in general, and of solid propellant materials, in particular. In the theoretical phase, an attempt was made to establish a tractable mathematical model taking into account the complex geometry of the internal passages of the propellant grain, and the fact that the motor is of finite length, thereby introducing possible interaction of end effects. Also, a method was devised for calculating the upper and lower bounds on eigenvalues in anticipation of the improbability of obtaining closed solutions for the natural frequencies of normal mode vibrations. D.T.

N66-26756*# Aerojet-General Corp., Sacramento, Calif.
LITTLE JOE II PROGRAM: MONTE CARLO STUDY OF MOTOR PERFORMANCE
[1966] 17 p
(Contract NAS9-456)
(NASA-CR-75212) CFSTI: HC $1.10/MF $0.50 CSCL 21H

The Monte Carolo method was used, with a series of ballistic evaluations, to determine the effects of propellant variability upon ballistic performance of Algol ID motors for the Little Joe II program. To predict the performance variations, values of selected propellant ballistic properties were sampled randomly from a normally distributed population of known mean and standard deviation. One hundred ballistic evaluations were made using these samples, and the resulting performance curves are presented in graphic form. The selected parameters were: density, flow coefficient, burning rate constant, throat area, initial and maximum pressure, maximum thrust, and duration. It is pointed out that the Monte Carlo method is the best technique for assessing the effects of variability in the

components of solid rocket motors. It is suggested, however, that individual motor predictions should be used for planning vehicle performance, with such predictions being based on nominal performance modified by the average burning rate of the propellant in the individual motor. D.T.

N66-26761*# Aerojet-General Corp., Sacramento, Calif.
LITTLE JOE II PROGRAM Test Data Book, Revision C
15 Sep. 1963 93 p refs
(Contract NAS9-456)
(NASA-CR-75264) CSCL 21H

Results of both motor and component tests for three full-scale Algol ID Mod I motors which were fired during the Little Joe II program are presented. Basic test requirements were to demonstrate the motor capability to ignite at altitudes over 100,000 ft; to determine pressure and thrust performance characteristics of the motor with a variable cant-angle nozzle positioned at from 0° to 14°; to determine performance variation of the units tested; and to demonstrate the ability of subassemblies to perform satisfactorily. Component tests were performed of igniter initiators (squibs), nozzles, motor chambers, weather seals, and destruct systems. Hydrostatic proof pressure tests results indicate that all motor chambers passed the test successfully. All nozzles tested with pressurized air proved out successfully and gave no indication of yield, deformation, or detrimental leakage. Test data for propellant burning rate tests are given. Also summarized are the results of the performance demonstration tests for the motor, igniter, nozzle, destruct system, and weather seal. Photographs of components and test set-ups are included along with various data curves, tables, and charts. L.S.

N66-26762*# Aerojet-General Corp., Sacramento, Calif.
LITTLE JOE II MOTOR DEVELOPMENT PROGRAM Final Report
25 Oct. 1963 131 p *Its* Rept.-0667-01F
(Contract NAS9-456)
(NASA-CR-75263) CFSTI: HC $4.00/MF $1.00 CSCL 21H

The design, development, fabrication, and delivery of motors and ground support equipment are described. The igniter capable of operating at an altitude of 100,000 ft, a destruct system, and a cantable nozzle for the Algol ID motor are discussed, along with ground support items. Component and systems drawings are included. N.E.N.

N66-26764*# Aerojet-General Corp., Sacramento, Calif.
LITTLE JOE II: ALGOL PROPULSION SYSTEM Technical Interface Control Document
1 Jul. 1963 80 p Prepared jointly with General Dynamics *Its* Rept.-0667-TICD-1
(Contracts NAS9-452; NAS9-456)
(NASA-CR-75262) CFSTI: HC $3.00/MF $0.75 CSCL 21H

The three basic interface areas between the Algol ID Mod 2 propulsion system and the Little Joe II vehicle are depicted. These interfaces are catagorized as physical, functional, environmental, and operational. The components and their characteristics are described. Component drawings and equipment specifications are presented. N.E.N.

N66-26775# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
DESIGN AND FLIGHT TESTS OF A MACH-5 EXPERIMENTAL RAMJET [ETUDE ET ESSAIS EN VOL D'UN STATOREACTEUR EXPERIMENTAL A MACH 5]
Roger Marguet 1966 37 p refs In FRENCH; ENGLISH summary
(TN-94(1966)) CFSTI: HC $2.00/MF $0.50

Studies and research on high speed atmospheric propulsion have lead O.N.E.R.A. to experiment in flight ten ramjet missiles. This operation received the code name STATALTEX. Four missiles reach a flight speed of nearly 4600 feet per second between the altitudes of 40,000 to 115,000 feet. In this paper the information obtained in the course of this study are described and theoretical predictions and experimental results are compared. The knowledge acquired permitted us to obtain useful data applicable to an eventual atmospheric booster able to reach Mach 5. Author

N66-26861*# McDonnell Aircraft Corp., St. Louis, Mo. Research Div.
STUDY OF ARC-JET PROPULSION DEVICES Final Report, 20 Nov. 1964–19 Dec. 1965
W. M. Van Camp, D. W. Esker, R. J. Checkley, W. G. Duke, J. C. Kroutil et al Mar. 1966 112 p refs
(Contract NAS3-5758)
(NASA-CR-54691; E368) CFSTI: HC $4.00/MF $0.75 CSCL 21C

The exhaust flow of arc jet propulsion devices was studied in order to identify factors in the energy transfer mechanism for the production of thrust and for the utilization of propellant energy. Three radiation and three water cooled constricted arc jets; a regeneratively cooled semi-constricted arc jet; and a water cooled high current MPD arc jet were used in the experiments; these are described in detail. The following measurements were made, and the results are given: mass flux, impact pressure, stagnation enthalpy, velocity profiles. The results of the measurements were used to determine electron concentrations, total power flux, kinetic power flux distribution; gas temperature profiles, and constrictor flow mixing. D.T.

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N66-25510# Manchester Univ., Macclesfield (England). Nuffield Radio Astronomy Labs.
THE DETERMINATION OF THE ACCURATE POSITIONS OF RADIO SOURCES BY THE LUNAR OCCULTATION TECHNIQUE. OBSERVATIONS OF GALACTIC AND EXTRA-GALACTIC EMISSION AT 408 MC/S Progress Report, Jul.–Sep. 1965
Conrad H. Slater, C. G. T. Haslam and M. J. S. Quigley [1965] 6 p refs
(Contract N62558-3928)
(PR-4; AD-630482) CFSTI: HC $1.10/MF $0.50

Equipment improvements are described for a proposed survey of galactic and extra-galactic emission at 408 Mc/s, and some plans are mentioned for the survey which will cover the region included by the right ascension 21h to 14h and declination from −20° to +40° or +60°. Observations are reported for the monitoring of radio emission from UV Ceti with the 408 Mc/s interferometer between the Mark I and Mark II telescopes. Determination of accurate positions of

radio sources by the lunar occultation techniques is also reported, with the interferometric record having good signal-to-noise ratio and with very little interference. In addition to the equipment used for the Ceti observations, a 240 Mc/s switched receiver was used on the Mark I telescope. M.W.R.

N66-25511# Manchester Univ., Macclesfield (England). Muffield Radio Astronomy Labs.

THE DETERMINATION OF THE ACCURATE POSITIONS OF RADIO SOURCES BY THE LUNAR OCCULTATION TECHNIQUE. OBSERVATIONS OF GALACTIC AND EXTRA-GALACTIC EMISSION AT 408 MC/S Progress Report, Apr.–Jun. 1965

Conrad H. Slater, C. G. T. Haslam, and M. J. S. Quigley [1965] 6 p refs

(Contract N62558-3928)

(PR-3; AD-630481) CFSTI: HC $1.10/MF $0.50

Instrumentation developments are described for a projected large area survey of galactic and extra-galactic emission at 408 Mc/s, and successful preliminary observations are reported with this equipment. Analysis of published data and theories on supernova remnants result in the conclusion that the lifetimes and space densities of these objects may be considerably higher than previously estimated. This conclusion supports a supernova theory of the north polar radio spur of the galaxy. M.W.R.

N66-25665# Tokyo Astronomical Observatory (Japan).

OBSERVATION OF THE SOLAR ELECTRON CORONA AT THE NORIKURA CORONA STATION DURING 1964

Shingo Nagasawa 1964 16 p refs *Its* Bull. of Solar Phenomena, Vol. 16, No. 5, Jan.–Dec. 1964

CFSTI: HC $1.00/MF $0.50

A K-coronameter was used to conduct observations of the solar electron corona. The calibration of the light intensity was performed by using a neutral tint filter of known transmission, introducing known amounts of polarization by inserting the filter into the light beam from the center of the sun, and tilting the filter to several known angles. The method used for the reduction of the sky and instrumental polarization is also discussed. Graphs of polar plots of the measured polarization in radial direction in terms of $B_{\odot}$ are shown. Included on each graph are the date of observation, the distance in minutes of arc from the center of the sun, and the time of observation. H.S.W.

N66-25709*# National Aeronautics and Space Administration, Washington, D. C.

ONE ANOMALY IN ELECTRON PITCH-DISTRIBUTIONS

O. L. Vaysberg and F. K. Shuyskaya *In its* Space Res. May 1966 p 273–276 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Processed data from the narrow-beam charged particle sensors aboard the Cosmos V satellite indicate satisfactory agreement between the density of the specular points, obtained from pitch distributions, and the electron intensities, observed at an angle of 90° to the force line. Widths of the electron pitch distributions indicate significant changes which exceed total scatter and observational errors, and it is considered that the energy of the electrons must also change. In order to clarify the roles of longitudinal and daily phenomena, a harmonic analysis is being made for all electron observations where $L \leq 2.0$; and preliminary data indicate that daily phenomena are at least as important as longitudinal ones. In order to a systematic daily shift, there are random fluctuations whose magnitudes exceed the observational errors. M.W.R.

N66-25710*# National Aeronautics and Space Administration, Washington, D. C.

VARIATIONS IN THE SOFT COMPONENT OF THE ELECTRON ENERGY SPECTRUM

T. M. Mulyarchik *In its* Space Res. May 1966 p 277–281 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Electron energy spectrum was determined by three sensors which were aboard both the Cosmos III and Cosmoc V satellites. It was found that electron energy increase caused by the accelerating voltage leads to a signal increase for an energy of ≤ 30 kev and to a signal decrease for energies between 50 and 150 KeV. There are practically no modulation changes for electrons of energies between 35 and 50 KeV and for those greater than 150 KeV. Signal ratios for all three sensors, without accelerating voltage, are strongly dependent upon electron energies up to 40 KeV, and remain almost constant between 50 and 70 KeV. Energy spectrum can be determined by combining the ratio of the three sensor signals with the sign and magnitude of the modulation, and various components of the spectrum and electron temperature changes are examined. M.W.R.

N66-25711*# National Aeronautics and Space Administration, Washington, D. C.

SPATIAL DISTRIBUTION OF DIFFERENT GROUPS OF TRAPPED CORPUSCLES BASED ON DATA FROM THE SATELLITES "KOSMOS 3" AND "KOSMOS 5"

V. V. Temnyy *In its* Space Res. May 1966 p 281–287 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Data collected by the Cosmos III and V satellites were examined to determine the nature of proton streams with energies greater than 50 Mev and electron streams with E>40 kev. Significant electron streams were recorded in those drift trajectory regions which descended toward the Earth to an altitude of $h_{min} < 100$ km in the region of the South Atlantic anomaly. In the anomaly region itself electron streams could not be recorded. No hypothesis is considered to satisfactorily explain the mechanism leading to the recorded stream change on the drift trajectory. A graph is included to show the distribution of trapped electron streams with energies greater than 40 KeV when allowances are made for longitudinal changes. M.W.R.

N66-25712*# National Aeronautics and Space Administration, Washington, D. C.

MEASUREMENT OF SOFT ELECTRON STREAMS IN THE UPPER ATMOSPHERE AT ALTITUDES TO 500 km

L. A. Antonova and T. V. Kazachevskaya *In its* Space Res. May 1966 p 288–291 (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

An open-type secondary-electron multiplier was used as a radiation detector to measure streams of soft electrons at altitudes up to 500 km. Average value of electron stream was estimated to be $\approx 5 \times 10^7$ electrons/cm^{-2}/sec^{-1}/$sterad^{-1}$; and mean flux of electrons with energies exceeding 35 KeV was estimated at 2×10^5. Assuming that the low energy spectrum boundary is less than 8 KeV, the estimate of mean energy flux does not depend on altitude. Electron streams measured by recording ionizing radiation with a thermoluminescent phosphor varied little with altitude and produced average measurements similar to those made by the electron multiplier. M.W.R.

N66-25721*# National Aeronautics and Space Administration, Washington, D. C.

STATE OF THE PROSPECTS FOR STUDYING THE RADIATION ZONES OF THE EARTH

S. N. Vernov *In its* Space Res. May 1966 p 375–386 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

A general discussion is presented on the radiation zones of the Earth, and speculations are offered about the mechanism which accelerates particles in these zones. Although the process for particle acceleration can be followed by recordings made at ground stations and on satellites, there are still gaps in the information that is necessary to provide definitive answers about the operation of a mechanism and/or more than one mechanism. It is pointed out that sometimes this acceleration process lasts only 0.1 sec, whereas it lasts for as long as several days in other cases. The latter is attributed to a betatron mechanism which results from particles being transferred from the remote regions of the magnetosphere to the Earth. M.W.R.

N66-25722*# National Aeronautics and Space Administration, Washington, D. C.

PENETRATION PROCESSES INTO THE MAGNETOSPHERE OF THE EARTH, CAPTURE AND ACCELERATION OF SOLAR STREAM PARTICLES, AND THEIR ROLE IN THE DYNAMICS OF THE GEOMAGNETIC TRAP

V. D. Pletnev, G. A. Skuridin, V. P. Shalitov, and I. N. Shvachvonov *In its* Space Res. May 1966 p 386–425 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

The interconnection between geophysical phenomena occurring in circumterrestrial cosmic space is investigated in terms of the dynamics of the geomagnetic trap. A modification of the classical method of Stormer is employed to estimate the motion of charged particles in the magnetosphere field. Penetration of charged particles within the magnetosphere is considered in the vicinity of neutral points; and polar and circular drift currents of the penetrating charged particles are diagrammed. Attention is given to capture of charged particles in the geomagnetic trap and their acceleration during the inverse phase of a magnetic storm, and various illustrations chart changes in magnetic field strength, electron stream intensity, and particle streams in outer zones during the inverse phase. Characteristically, intense streams of trapped particles appear during the inverse phase, while the most energetic electrons appear at the end of the phase. M.W.R.

N66-25723*# National Aeronautics and Space Administration, Washington, D. C.

ANOMALOUS DIFFUSION OF CHARGED PARTICLES IN THE RADIATION ZONES OF THE EARTH

B. A. Tverskoy *In its* Space Res. May 1966 p 426–442 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Data are presented to show that the basic mechanism for accelerating protons and electrons in the outer zone and the formation of the inner zone is the transfer of particles across drift envelopes. Basic theory of particle transfer is discussed in detail, and experimental results obtained during satellite flights are presented. Considered are protons and hard electons of the outer zone and high energy protons. Theoretical and experimental evidence shows that anomalous diffusion plays a very important role in the dynamics of the radiation zones of the Earth. The theory of anomalous diffusion fully solves the problem of the outer proton zone and overcomes difficulties related to different anomalies in the high-energy proton spectrum. The concept of particle transfer across the drift envelopes, with allowances for magnetic scattering, permits for understanding of the outer electron zone and, possibly, the formation of the current ring during magnetic storms. M.W.R.

N66-25724*# National Aeronautics and Space Administration, Washington, D. C.

THE FORMATION OF RADIATION ZONES AS A RESULT OF PARTICLE DRIFT IN THE DEPTHS OF THE MAGNETOSPHERE

A. Ye. Antonova, A. I. Yershkovich, and V. P. Shabanskiy *In its* Space Res. May 1966 p 442–453 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

The effectiveness of an albedo neutron source for the formation of a relativistic neutron zone is determined, and a particle whose reflection point lies close to the plane of the geomagnetic equator is investigated. Since the neutron source is not powerful enough to create the proton streams that have been observed, it is assumed that the proton zone results from the drift toward the Earth of protons in the layer between the magnetosphere boundary and the front of a stationary shock wave. Attention is given to the calculation of proton drifts and losses, and the determination of the proton stream at the magnetosphere boundary. Since radial drift under the influence of hydromagnetic waves propagated toward the Earth does not depend on either particle mass or energy, this drift cannot be the only mechanism leading to the formation of electron and proton zones having similar energies. The source of relativistic electrons, or the density of the albedo neutron decay in the magnetosphere, is assumed to be preset; whereas the strength of the proton source strength is not. M.W.R.

N66-25725*# National Aeronautics and Space Administration, Washington, D. C.

COMPARISON OF SIMULTANEOUS MEASUREMENTS OF THE MAGNETIC FIELD AND POSITIVE ION STREAMS WITHIN THE EARTH'S MAGNETOSPHERE, PERFORMED ON THE SATELLITE "ELEKTRON-2"

K. I. Gringauz, Sh. Sh. Dolginov, V. V. Bezrukikh, Ye. G. Yeroshenko, L. N. Zhuzgov et al *In its* Space Res. May 1966 p 457–463 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Measurements made by a charged particle trap, magnetometers, and other instruments carried on the Elektron II satellite indicate that there is a correlation between changes in the magnetic activity of the Earth's surfaces and changes in the geomagnetic field strength and positive ion streams at great distances from the Earth. The correlation exists during the initial flight period of the satellite within the magnetosphere; there is no relationship seen beyond the magnetosphere and for the rest of the flight. It is noted that on one day the increase in positive ion streams anticipated a magnetic field increase by about three hours; and that this increase close to the satellite and on the Earth began almost simultaneously. Further, increase in magnetic field strength was at a much faster rate than that at which the trap changed from recording negative to positive collector currents. Positive ion streams observed on the Explorer XII satellite are discussed, but the same correlations are not found for these observations. M.W.R.

N66-25726*# National Aeronautics and Space Administration, Washington, D. C.

INVESTIGATION OF THE EARTH'S MAGNETOSPHERE IN THE RADIATION ZONE REGION (3-6R_e) FEBRUARY–APRIL, 1964

Sh. Sh. Dolginov, Ye. G. Yeroshenko, and L. N. Zhuzgov *In its* Space Res. May 1966 p 464–482 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Orbit of the Elektron II satellite, meteorological features of the equipment on board, and nature of the magnetometric observations made are discussed in an investigation of the Earth's magnetosphere. Scalar field values are calculated along the

trajectory from data received from the three magnetometer channels. Various calculations are reported for magnetic fields of trapped radiation, and there appears to be corroboration for the view that protons and electrons forming the outer radiation zone have diffused inward into the magnetosphere from its boundaries. The measurements made in the 3–6 R_e (Earth's radius) indicate that there is a quiet day outer magnetic field associated with the protons and electrons of the radiation zones. M.W.R.

N66-25727*# National Aeronautics and Space Administration, Washington, D. C.

STUDY OF THE EARTH'S MAGNETOSPHERE AT A DISTANCE OF 7–11.7 R_e ON THE "ELEKTRON" SATELLITES

Ye. G. Yeroshenko *In its* Space Res. May 1966 p 483–498 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

A comparison was made of satellite magnetograms of ΔT, at distances of 7–11.7 R_e data derived from ground stations; and a close correlation is found between these ΔT values and magnetic activity on the Earth's surface. A diurnal variation in ΔT is noted, and during magnetic storms there is a smooth increase in the positive values. In fact, any magnetic perturbation resulted in an increase. Along with large-scale changes in time of positive values, there are short-lived deviations of ΔT with sharp fronts which correspond to the development of aurorae polaris. Results from processing magnetic data obtained from the Elektron II satellite indicate that the magnetosphere boundary was located above the satellite apogee; and preliminary analysis of data obtained during the initial operational period of Elektron IV show, at least for the period of the magnetic storm, that the satellite intersected the magnetosphere boundary on the diurnal side. M.W.R.

N66-25728*# National Aeronautics and Space Administration, Washington, D. C.

STRUCTURE OF THE SOLAR CORPUSCULAR STREAM AND ITS INTERACTION WITH THE MAGNETOSPHERE OF THE EARTH

Yu. D. Kalinin and E. I. Mogilevskiy *In its* Space Res. May 1966 p 499–517 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Comparisons of data collected from the IMP-I and other satellites with terrestrial observations indicate that a decisive role is played by the stream magnetic field in the transfer of perturbations to the Earth's magnetosphere. There appears to be direct agreement between the D_{st}-variations of the geomagnetic field and the field variation beyond the boundaries of the magnetosphere. A scheme is proposed to explain the interaction of stream magnetic field with magnetosphere. Structure of the solar corpuscular stream is discussed, along with the important role of its magnetic field in transmitting energy into the magnetosphere. M.W.R.

N66-25729*# National Aeronautics and Space Administration, Washington, D. C.

RECORDING CHARGED PARTICLES WITH AN ENERGY OF 0.1–10 KeV WITH A SPHERICAL ELECTROSTATIC ANALYZER

S. N. Vernov, V. V. Mel'nikov, I. A. Savenko, B. I. Savin, and T. I. Pervaya *In its* Space Res. May 1966 p 518–525 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Design and characteristics of the spherical electrostatic analyzers aboard Cosmos XII, Cosmos XV, and Elektron II are discussed; and use of these analyzers in recording charged particle cross sections is reported. During the Cosmos flights, regions of elevated electron intensity were reported in the area of maximum southern isochasm south of New Zealand. Sporadic rises in electron intensity were detected in the region of the orbital apogee of Elektron II; and sporadic streams are noted for recordings at southern geomagnetic latitudes between midnight and morning meridians at radial distances >9 R_e. Present concepts and onboard magnetometer readings indicate that Elektron II did not go beyond the boundaries of the magnetosphere, and that the sporadic streams were detected within the magnetosphere on force lines going toward the nocturnal side and remaining there during the daily rotation of the earth. According to the Elektron II analyzer data, fluxes of positive ions with energies between 0.1 and 10 KeV do not exceed $5\times10^{7}\,cm^{-2}/sec^{-1}$. M.W.R.

N66-25730*# National Aeronautics and Space Administration, Washington, D. C.

PHYSICAL PICTURE OF THE FORMATION OF AN ARTIFICIAL RADIATION ZONE DURING THE HIGH-ALTITUDE, AMERICAN THERMONUCLEAR EXPLOSION ON JULY 9, 1962

Yu. I. Gal'perin *In its* Space Res. May 1966 p 526–533 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

The fission fragment distribution in the upper atmosphere following a thermonuclear explosion is illustrated, and the artificial radiation following a high altitude burst is discussed in terms of observations made by the Cosmos V satellite. Three mechanisms are suggested for the ejection of particles beyond the cloud limits: (1) diamagnetic ejection of plasma clusters beyond the plasma field boundary which is unstable; (2) free scattering into the magnetosphere of fission fragments neutralized during the initial stages of the explosion cloud expansion; and (3) free scattering due to recharging of plasma cloud ions with neutral atmospheric particles. M.W.R.

N66-25731*# National Aeronautics and Space Administration, Washington, D. C.

RESULTS DERIVED FROM STUDYING THE GEOMETRIC POSITION AND PARTICLE COMPOSITION OF RADIATION ZONES OF THE EARTH BASED ON DATA FROM THE SATELLITES "ELEKTRON-1" AND "ELEKTRON-2"

S. N. Vernov, A. Ye. Chudakov, P. V. Vakulov, Ye. V. Gorchakov, S. N. Kuznetsov et al *In its* Space Res. May 1966 p 535–550 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

An overall picture of the hard component distribution of radiation zones of the earth is compiled from data obtained by the Elektron I and Elektron II satellites. It is found that a zone of artificially-injected electrons is located very near the earth, with the maximum for L=1.45 (L=the McIlwain parameter). At the maximum, the flux of electrons having energies > 2 MeV is $\sim1\times10^{7}\,cm^{-2}/sec^{-1}/sterad^{-1}$; mean directional flux of protons with energies between 45 and 70 MeV is $1.5\times10^{3}\,cm^{-2}/sec^{-1}/sterad^{-1}$. When L=2.2, for protons with energies >50 MeV, the spectrum becomes harder. Spatial distributions of protons and electrons are different at energies between one and several MeV, with proton distribution a function of energy. At L+2.75 a zone of high energy electrons is discovered. A minimum was observed in the distribution of electrons with energies >150 KeV $3<L<4$ region; and the maximum of the outer zone, both on the nocturnal and morning sides, is on the average at L=4.8. It is noted that in the energy region greater than one MeV, the electron spectrum is on the average softer than results of preceding years indicated. M.W.R.

N66-25732*# National Aeronautics and Space Administration, Washington, D. C.

PRELIMINARY RESULTS DERIVED FROM CORPUSCLE INVESTIGATIONS ON THE SATELLITE "ELEKTON-I"

A. D. Bolyunova, O. L. Vaysberg, Yu. I. Gal'perin, B. P. Potapov, V. V. Temnyy et al *In its* Space Res. May 1966 p 551–566 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

The radiation distribution of charged particles trapped in the geomagnetic field was measured by signals obtained from corpuscular indicators carried aboard the Elektron-I satellite. The data obtained are depicted in several graphs and are discussed. Results indicate that at low altitudes ($L<2$) close to the equator, the predominant factor in particle stream magnitude is electrons of natural origin with energies of 20 keV to 200 keV and fluxes up to 2×10^{9} particles·cm^{-2} sec^{-1}. In the same region, heavy electrons artificially injected into the geomagnetic field from a thermonuclear explosion with energies in the order of several MeV and fluxes up to 2×10^{8} particles·cm^{-2}·sec^{-1} were also detected, along with trapped protons with energies in the order of tens and hundreds of MeV with fluxes of up to about 5×10 particle·cm^{-2}·sec^{-1} ($E>50$ MeV). At mean latitudes there was a sharp increase in the stream of soft protons with energies of several hundred keV with minimum fluxes of 10^{8} particle·cm^{-2}·sec^{-1}. At higher latitudes there were both protons and electrons, but the electron component had low energy ($E\geq20$ keV) and was very unstable, particularly when geomagnetic activity increased. The boundary of the capture zone in the geomagnetic field during a magnetically quiet period coincided with the outlines of the instantaneous aurorae polaris zone reflecting daily magnetosphere asymmetry. L.S.

N66-25733*# National Aeronautics and Space Administration, Washington, D. C.

POSSIBLE EXISTENCE OF A SOFT ELECTRON COMPONENT IN THE OUTER RADIATION ZONE AND ITS VARIATIONS

V. V. Bezrukikh, K. I. Gringauz, L. S. Musamov, and E. K. Solomatina *In its* Space Res. May 1966 p 566–568 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Results of electron flux measurements made by recordings of a negative collector aboard the satellite Elektron-II are presented. The satellite also collected other charged particle stream data by means of other charged particle trapping apparatus. When the satellite passed through the outer radiation zone, the negative current magnitude changed considerably with each revolution of the collector. With some samplings, practically no negative currents were observed. At the same time, the radiation counters carried by the satellite indicated that the energetic particles recording rates (with $E>100$ keV) were fairly stable. This phenomenon is graphically depicted. These results indicate that a soft component of electron streams exist in the outer radiation zone, with a variability in time much greater than the variability of high energy particle streams. The collector currents recorded by the trap are formed by electrons with energies not exceeding 100 keV. The region containing these soft electron streams appears to extend beyond the limits of the outer radiation zone boundary. L.S.

N66-25734*# National Aeronautics and Space Administration, Washington, D. C.

TIME CHANGES IN THE OUTER RADIATION ZONE OF THE EARTH BASED ON DATA FROM THE "ELEKTRON" SATELLITES

S. N. Kuznetsov, E. N. Sosnovets, and V. G. Stolpovskiy *In its* Space Res. May 1966 p 569–575 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Time changes in the outer radiation zone on the nocturnal side of the earth based on data recorded by Elektron-1 and Elektron-II satellite detectors are investigated. Data plots of the change in electron intensity at the zone maximum, and in the magnetic activity are presented, and are compared with data obtained by the Explorer satellites. Analysis of the data, indicates that the outer radiation zone is very sensitive to the magnetic environment, and that the space between the outer and inner zones apparently demarcates the magnetosphere regions in which trapped radiation behaves differently. A scale of time variations in the radiation zones during a quiet sun year were established, and a connection between certain particle variations and geomagnetic phenomenon was found. L.S.

N66-25735*# National Aeronautics and Space Administration, Washington, D. C.

IRREGULAR HIGH-ENERGY ELECTRON STREAMS NEAR THE BOUNDARY OF THE RADIATION ZONES OF THE EARTH

S. N. Vernov, A. Ye. Chudakov, P. V. Vakulov, S. N. Kuznetsov, Yu. I. Logachev et al *In its* Space Res. May 1966 p 576–587 refs (See N66-25686 14-13) CFSTI: HC $8.35/ $4.50

The results of data obtained from two different satellites, the Elektron-I and Elektron-II, pertaining to irregular high energy electron streams near the boundary of the radiation zone surrounding the earth, are presented. The two-satellite system has the advantage of studying simultaneously radiation at two different points in space. Data curves of the intensity of the electon streams measured on different days, during quiet periods, during a polar storm, at different latitudes, and at various trajectory positions are given. The electron steams studied were observed in the southern hemisphere on the nocturnal side. In addition, data showing the distribution of magnetic perturbations over the northern polar cap are depicted. The concurrent occurrence of these events apparently indicates closed force lines of the earth's magnetic field up to a latitude of 75°. No definite conclusions can yet be drawn regarding the connections between the aurorae polaris and the existence of non-stationary electron streams beyond the zone boundary due to the lack of constant detailed observations of the aurorae polaris, but evidence indicates a great probability that such a connection exists. L.S.

N66-25736*# National Aeronautics and Space Administration, Washington, D. C.

STUDY OF THE EARTH'S OUTER RADIATION ZONE AT LOW ALTITUDES DURING SPACECRAFT-SATELLITE FLIGHTS AND THE "KOSMOS" AES FLIGHTS BETWEEN 1960 AND 1963

S. N. Vernov, V. Ye. Nesterov, N. F. Pisarenko, I. A. Savenko, L. V. Tverskaya et al *In its* Space Res. May 1966 p 588–606 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Data curves of the earth's outer radiation zone, obtained from scintillation counter detectors and spherical electrostatic analyzers aboard several satellite flights (including certain satellites in the Cosmos series) at low altitudes in the period between 1960 and 1963 are presented. A brief description of the composition and characteristics of each recorder is given. A detailed analysis of the data is presented and gives an improved picture of the structure and dynamics of the radiation zone; and will be helpful in clarifying the mechanism connection between magnetic storms and the aurorae polaris. Although the data on electrons of energies $>10^{5}$ ev (which only comprise a small portion of the electrons in the spectrum recorded in the outer radiation zone) indicate that their total energy is inadequate to produce such geophysical phenomena as the aurorae polaris, they nevertheless represent an unusual indicator of the geophysical environment and should be useful for clarifying the mechanism. L.S.

N66-25737*# National Aeronautics and Space Administration, Washington, D. C.

STUDY OF THE INNER AND ARTIFICIAL RADIATION ZONES OF THE EARTH AT LOW ALTITUDES IN 1960–1964

V. Ye. Nesterov, N. F. Pisarenko, I. A. Savenko, M. V. Tel'tsov, P. I. Shavrin et al *In its* Space Res. May 1966 p 607–615 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

A supplementary analysis of experimental data obtained from radiometric apparatus carried aboard seven earth satellite probes (Cosmos-IV, Cosmos-VII, Cosmos-IX, Cosmos-XII, Cosmos-XV and two satellites referred to as second and third speacecraft) which revealed a region of high radiation intensity around the coast of Brazil (called the Brazilian magnetic anomaly) is presented. Details of the data relating to the (1) longitudinal behavior of protons and spatial distribution of inner zone particles, (2) time variations in the inner radiation zone of the anomaly region, and (3) spatial distribution and lifetime of artificial zone electrons are discussed, with accompanying graphic illustrations. L.S.

N66-25738*# National Aeronautics and Space Administration, Washington, D. C.

OUTER RADIATION ZONE OF THE EARTH AND BURSTS OF X-RAY RADIATION IN THE STRATOSPHERE

S. N. Vernov, L. L. Lazutin, A. N. Charakhch'yan, and T. N. Charakhch'yan *In its* Space Res. May 1966 p 616–623 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Recorded data obtained from simultaneous measurements made by a single counter (in conjunction with a telescope) carried aboard an earth satellite flight made on May 12, July 12, and July 15, 1959 during a period of cosmic ray bursts in the stratosphere above Murmansk, are presented in tabular form and are discussed. The data are compared with observations of the activity over other parts of the globe by other observers, and to similar activity from other time periods. Photon and electron flux data were used as criterion in evaluating the effects of the burst on the stratosphere. The data on electrons pouring out of the outer radiation zone, indicate that in many cases, X-radiation in the stratosphere is due an additional stream of electrons which are formed during non-stationary processes of electron acceleration occurring in the earth's magnetosphere. The effectiveness of this process intensifies as solar activity decreases. Several graphs accompany the data. L.S.

N66-25739*# National Aeronautics and Space Administration, Washington, D. C.

MEASUREMENT RESULTS ON THE SATELLITE "KOSMOS-41" IN THE OUTER RADIATION ZONE

S. N. Vernov, I. A. Savenko, M. J. Tel'tsov, and P. I. Shavrin *In its* Space Res. May 1966 p 623–629 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Data plots of radiation trapped in the outer radiation zone of the earth's magnetic field by radiometric apparatus carried aboard the Cosmos-XLI satellite (launched on August 22, 1964) are presented. Curves are given showing proton and electron intensity changes, magnetic field strength, and other recorded data, as functions of detector equipment current parameters on several different days and at various positions of the satellite probe. A table listing the composition of the apparatus used (type of detector, shielding, geometric factor, and type and energy of particles recorded) is given. L.S.

N66-25740*# National Aeronautics and Space Administration, Washington, D. C.

THE OUTERMOST ZONE OF CHARGED PARTICLES

K. I. Gringauz and M. Z. Khokhlov *In its* Space Res. May 1966 p 633–652 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Results derived from studying zones of charged particles with comparatively low energies (from ≈100 eV to 10 keV–40 keV) located beyond the outer radiation zone are examined. A table listing in chronological order (according to launch date) the space vehicles from which the date on soft electron and proton streams were obtained, is given. (These vehicles are the Luna-I, Luna-II, Explorer-XII, Explorer-XVIII, Mars-I, Elektron-II, and the Zond-II). Also listed is the observational method used for each flight, and the value of the angle λ_{es} corresponding to the observational times. The orbits of most of the above vehicles passed close to the ecliptic plane. Only Mars-I and Elektron-II observed electron streams with $E_e >$ 100 eV beyond the trapped radiation boundaries at high latitudes. Graphic depictions of collector currents and components of these currents recorded from the satellites are presented. Schematic portrayals showing the spatial distribution of the soft electron and proton streams surrounding earth and of the magnetic field structure surrounding the earth are also presented. The relationship between the intensity of the soft electron streams, the orientation of the earth's magnetic dipole axis with respect to its direction toward the sun, and geomagnetic activity is discussed. L.S.

N66-25741*# National Aeronautics and Space Administration, Washington, D. C.

PROBLEMS OF AND PROSPECTS FOR PRIMARY COSMIC RAY RESEARCH

V. L. Ginzburg, L. V. Kurnosova, L. A. Razorenov, S. I. Syrovatskiy, and M. I. Fradkin *In its* Space Res. May 1966 p 657–677 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Problems regarding research into the proton–nuclear, electron–positron, cosmic γ-ray, and X-ray components of primary cosmic rays are discussed. Data obtained from measurements made by detectors aboard earth satellite probes, and from other sources are considered with respect to information regarding (1) the energy spectrum of protons and nuclei in the energy range below 100 Mev/nucleon; (2) atmospheric proton flux; (3) the ratios between fluxes of various nuclear groups (L, M, H) in the low energy region; (4) the isotopic composition (hydrogen, helium, and carbon isotopes) of primary cosmic radiation; (5) antiproton formation from interactions of the cosmic ray protons with interstellar matter; (6) superheavy nuclei; (7) time change effects on the flux of various nuclear components; (8) gradient effects; (9) anisotropy; (10) flux and energy spectrum of the electron–positron component; (11) ratios between positron and electron fluxes; and (12) radiation mechanisms (formation and decay of particles). The information presented should be very useful in clarifying the nature of cosmic radiation. L.S.

N66-25742*# National Aeronautics and Space Administration, Washington, D. C.

STUDIES OF PRIMARY COSMIC RADIATION ON THE SATELLITES "ELEKTRON-2" AND "ELEKTRON-4"

S. N. Vernov, P. V. Vakulov, V. I. Zatsepin, Yu. I. Logachev, V. P. Okhlopkov et al *In its* Space Res. May 1966 p 678–683 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Counting rate data of primary cosmic radiation which were recorded by gas discharge counters (screened by either aluminum or lead shielding of varying thicknesses and length) carried aboard the Elektron-II and Elektron-IV earth satellites are

graphically depicted, and are discussed. The surface of the Elektron-IV counter exceeded the surface of the counter on Elektron-II by a factor 1.06. The threshold energy for proton recording was about 45 MeV. Data plots are given for several flights during the period Jan 30 and Nov 1, 1964. The data were also analyzed with respect to solar revolutions. It appears that the variations of the radiation intensity measurements are not related to solar rotation, but are caused by a mechanism dictating the 11-year intensity variations of cosmic rays. L.S.

N66-25743*# National Aeronautics and Space Administration, Washington, D. C.

STUDY OF COSMIC RAYS DURING FLIGHTS OF SPACECRAFTS-SATELLITES AND THE "KOSMOS" AES

R. N. Vasilova, V. Ye. Nesterov, N. F. Pisarenko, I. A. Savenko, and P. I. Shavrin *In its* Space Res. May 1966 p 684–688 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Data on cosmic ray intensity changes in the earth's radiation zone recorded by STS-5 gas discharge counters aboard six different earth satellites (Cosmos-IV, Cosmos-IX, Cosmos-XII, Cosmos-XV, and two satellites called the second and third spacecraft satellite) are presented. The counters were originally designed to measure charged particle streams, but the data presented illustrate that cosmic ray intensity can be monitored by the instrument through reducing data on time variations of cosmic rays on the satellites and from measuring the cosmic ray equator. A table of the orbital parameters and measurement times of the satellites carrying the STS-5 counters is given. Also presented are data plots showing the dependence of cosmic ray intensity on hardness threshold for all six satellites; the time behavior of cosmic ray intensity on the high latitudinal plateau; and a differential spectrum of other radiation particles (obtained by subtracting the spectrum of these additional radiation particles from the integral hardness spectrum of these same particles). A comparison of the differential spectrum (in which appear particles in the energy range of 0.25 BeV to 3.0 BeV), with the same spectrum obtained by comparing the gas discharge counter recording rates on the Cosmos-17 and Explorer-7 shows that the spectra closely coincide. This indicates that multiplication and absorption are of no importance in this energy range. L.S.

N66-25744*# National Aeronautics and Space Administration, Washington, D. C.

RESULTS DERIVED FROM STUDYING THE COSMIC RAY NUCLEAR COMPONENT ON THE SATELLITE "ELEKTRON-2"

Ya. A. Blokh, L. I. Dorman, L. V. Kurnosova, V. I. Logachev, G. F. Platonov et al *In its* Space Res. May 1966 p 693–710 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Nuclei flux intensity data measured by recording equipment aboard the Elektron-2 satellite for studying the nuclear component of primary cosmic radiation, and for determining the flux changes as a function of solar activity during the International Quiet Sun Year, are presented. The equipment consisted of two recorder units. The recorder units contained Cherenkov and scintillation counters, and telescopes. The fluxes of different nuclei groups measured by the Elektron-II under conditions when the earth's magnetic field had no effect on their magnitudes, are compared with fluxes measured by other satellites where the magnetic field did affect the magnitude. A more detailed analysis of all the cases reported is still to be presented. L.S.

N66-25745*# National Aeronautics and Space Administration, Washington, D. C.

MEASUREMENT OF SOLAR X-RAY RADIATION INTENSITY BY MEANS OF THE SPACE STATION "ELEKTRON-2"

I. P. Tindo *In its* Space Res. May 1966 p 714–731 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Variations in a stream of soft X-ray radiation from a quiet sun, and in streams during brief bursts of intensity were recorded by radiation receivers aboard the flights of the Elektron-II and Elektron-IV satellites at the beginning and in the middle of 1964 beyond the boundary of the outer radiation zone. The radiation receivers used in the experiments consisted of end-window Geiger photon counters with windows made of beryllium and aluminum foil having densities of 25 $mg.cm^{-2}$ and 2.7 $mg.cm^{-2}$ respectively. Recording rate readings are depicted graphically for different revolutions of the counters (data sampling) at various points in time. The data are correlated, compared, and discussed. Some general observations are made, but conclusions are left for more detailed analysis of the data. L.S.

N66-25746*# National Aeronautics and Space Administration, Washington, D. C.

COSMIC RAY GENERATION ON THE SUN

A. N. Charakhch'yan and T. N. Charakhch'yan *In its* Space Res. May 1966 p 732–739 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

This article examines the behavior of cosmic ray bursts from the sun and the resulting phenomena in the upper atmosphere. Included are discussions of the proton energy spectrum in bursts, the diffusion of solar cosmic ray protons in interplanetary space, data on the coefficient of diffusion, field strength in magnetic nonuniformities, cosmic ray bursts generated on the backside of the solar disk, and radial solar magnetic fields. R.N.A.

N66-25748*# National Aeronautics and Space Administration, Washington, D. C.

RADIATION SAFETY PROBLEMS IN SPACE FLIGHTS

V. Ye. Nesterov, N. F. Pisarenko, I. A. Savenko, and P. I. Shavrin *In its* Space Res. May 1966 p 758–763 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

This article examines the problem of radiation safety in space flights. The three types of ionizing radiation encountered in space include primary cosmic radiation, radiation from the earth's radiation belts, and radiation generated during major chromospheric flares on the sun. Each of these types is examined in detail. Several problem areas of radiation safety which need investigating are outlined. R.N.A.

N66-25750*# National Aeronautics and Space Administration, Washington, D. C.

MEASUREMENT OF SCATTERED L_α-RADIATION IN THE VICINITY OF THE EARTH AND IN INTERPLANETARY SPACE

V. G. Kurt *In its* Space Res. May 1966 p 769–775 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

The Zond-1 spacecraft carried apparatus for measuring scattered ultraviolet radiation in the vicinity of the earth and in interplanetary space. The equipment consisted of two photon counters with windows made of lithium fluoride and NO filling, as well as a two-channal intensimeter with logarithmic outputs in a recording rate range from 3 to 10^4 impulse/sec^{-1}. Close to the earth, Zond-1 moved at a 90° angle to the earth-sun line, rotating around an axis directed toward the sun. The optical photometer axis described a cone with an opening angle of 160°. At a distance ranging from 37 to 47 thousand

km, four complete photometer cross sections of the earth's hydrogen corona were obtained. The photometer axis thus passed at a distance of 8700 km from the earth's center. Data were also obtained at distances ranging from 180 thousand to 15 million km. Results show that even at these latter distances, there is a significant amount of hydrogen. The change in intensity from 180 thousand to 15 million km is 1.5×10^7 quantum/cm^{-2}/sec^{-1}/$sterad^{-1}$. When relating this quantity to the distance 2×10^5 km it is found that the mean hydrogen concentration at a distance of 250,000 km is on the order of 1 to 10 cm^{-3}. R.N.A.

N66-25753*# National Aeronautics and Space Administration, Washington, D. C.
INFLUENCE OF SATELLITES ON RADIATION INTENSITY IN THE RADIATION ZONES
P. V. Vakulov *In its* Space Res. May 1966 p 817–821 refs
(See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

This paper discusses the possibility of using satellites to reduce the radiation intensity of the earth's radiation belts. A satellite passing through a radiation zone will be bombarded by the charged particles of the zone, thus destroying themselves. Since the number of particles absorbed by a satellite is proportional to its surface, a fairly large satellite can substantially decrease the intensity in those regions of the radiation zone which it intersects. It is estimated that a satellite with a diameter of 150 m can lower the lifetime of electrons in the artificial radiation zone produced by Starfish to three months as compared with the present mean lifetime of about 10 years. The reduction of Mars' radiation zones by satellites is also discussed. R.N.A.

N66-25894# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Flight Dynamics Lab.
SOLAR SIMULATION IN THE VACUUM AND EXTREME ULTRAVIOLET
Vernon L. Mangold Jan. 1966 51 p
(AFFDL-TR-65-189; AD-630470) CFSTI: HC $3.00/MF $0.50

Solar radiation in the wavelength region of 2000 angstroms down to 500 angstroms consists of two spectral ranges: (1) 2000 to 1600 angstroms wavelength range consists of a continuum characterized by the 4500K black body radiation curve; (2) 1600 to 500 angstroms wavelength range consists of lines and a blend of lines spectra particularized by the spectral line of Lyman Alpha (1215.7A). Sources for simulating and detectors for detecting the solar ultraviolet radiation in the wavelength range of interest are described in some detail. Source operating parameters and detector calibration techniques have been developed and are readily adaptable for solar simulation in the wavelength range of 2000 to 500 angstroms. Author (TAB)

N66-25946# Lowell Technological Inst. Research Foundation, Mass.
STUDY OF ABSORPTION AND REFRACTION CHANGES IN RADIATION EMANATING FROM JUPITER AND RADIO STARS Scientific Report No. 1
C. L. Bennett, Jr., K. Bibl, D. N. Gaunt, and B. W. Reinisch Nov. 1965 68 p refs
(Contract AF 19(628)-234)
(AFCRL-65-910; AD-630112) CFSTI: HC $6.60/MF $0.75

Jupiter's radio noise has been monitored by a continuously operated sweep-frequency interferometer. The properties of the system have been studied in estimating the possible errors induced by refraction in the earth's ionosphere; the method for ray path computations which allows for refraction error estimation is described. Precise measurements of the frequency dependence of the Faraday effect upon elliptically polarized radio emissions permit the determination of the main polarization axis at the source. The coincidence of the polarization plane and Jupiter's equator supports a tide model of Jupiter's ionosphere. Jupiter's longitude and the position of its moon Io define the probability of radio noise emissions, their frequency-time behavior and to some degree their polarization character and dependence on solar cycle. These phenomena are explained by assuming a sole radio-noise source fixed at the surface of the planet and large tidal amplitudes in Jupiter's ionosphere. Energy of isotropic radio-source propagates between surface and ionosphere and escapes through a tidal density minimum which forms a 'window' in the ionosphere. Author (TAB)

N66-26170# Harvard Coll. Observatory, Fort Davis, Tex. Radio Astronomy Station.
CATALOG OF HIGH ENERGY SOLAR PARTICLE EVENTS, 1957–1961 Scientific Report No. 7
P. Cummings Dec. 1965 22 p refs
(Contract AF 19(628)-2370)
(AFCRL-66-140; AD-630255) CFSTI: HC $1.00/MF $0.50

This catalog lists high energy solar particle events which occurred in the period 1957–1961. The sources of information are tables of solar particle events compiled by other authors and individual papers concerning specific solar events. A complete list of references is included. Author (TAB)

N66-26334# Geo-Science, Inc., Alamogordo, N. Mex.
SOLAR RESEARCH AND DEVELOPMENT AT SACRAMENTO PEAK OBSERVATORY Scientific Report No. 1, 1 Jan. 1964–31 Dec. 1965
Mark W. Jones Jan. 1966 23 p
(Contract AF 19(628)-3853)
(AFCRL-66-92; AD-630658) CFSTI: HC $2.60/MF $0.50

The fundamental research work included studies of events preceding solar flares such as filament and plage activity, solar surges, and H alpha activity with the goal of increasing the reliability of predicting solar flares. The electronics research group contributed to the highly specialized instrumentation development at the observatory. These contributions included the design and development of units to aid in the data reduction, control systems for the various spectrograph and coronagraph systems, control systems for the flare patrol program, and the development of a Videx system for transmission of solar flare pictures to AFCRL Headquarters and Ent AFB. The staff also participated in the solar eclipse expedition and designed and tested the control systems for two eclipse spectrographs. Author (TAB)

N66-26379# Harvard Coll. Observatory, Cambridge, Mass. Solar Dept.
CLASSIFICATION OF SOLAR PROMINENCES FOR SUNSPOT CYCLE NO. 19-1963 Scientific Report No. 6
Donald H. Menzel and F. Shirley Jones Jan. 1966 107 p
Contract AF 19(628)-3322)
(AFCRL-66-65, AD-629956) CFSTI: HC $4.00/MF $0.75

This report contains a tabulation and analysis of the behavior classification of prominences observed during 1963 at the Sacramento Peak Observatory, Sunspot, New Mexico. Author (TAB)

N66-26644*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATION OF THE ELEMENTAL ABUNDANCES IN LOW-ENERGY COSMIC RAYS IN JULY 1964

C. E. Fichtel and D. Reames Apr. 1966 22 p refs (NASA-TM-X-55476; X-611-66-138) CFSTI: HC $1.00/MF $0.50 CSCL 20H

In a sounding rocket experiment, nuclear emulsion detectors were used to study the composition and fluxes of primary cosmic-ray nuclei with charge $Z \geq 3$ above the atmosphere in the region of kinetic energy from 40 to 220 MeV/nucleon. The results show a light ($3 \leq Z \leq 5$) to medium ($6 \leq Z \leq 9$) flux ratio of .16±.07 in the 40 to 100 MeV/nucleon region and a heavy ($Z \geq 10$) to medium ratio of .42±.11 in the 70 to 160 MeV/nucleon interval. The elemental structure of the medium nuclei is found to contain (40±7)% carbon, (10^{+4}_{-6})% nitrogen and (48±7)% oxygen. Extrapolating the fluxes back through approximately 2.5 g/cm^2 of interstellar hydrogen to the source, one finds a flux of nitrogen consistant with zero.

Author

N66-26647*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SOLAR COSMIC RAY MULTIPLY CHARGED NUCLEI AND THE JULY 18, 1961 SOLAR EVENT

S. Biswas, C. E. Fichtel, and D. E. Guss Apr. 1966 24 p refs (NASA-TM-X-55475; X-611-66-137) CFSTI: HC $1.00/MF $0.50

Energetic helium and heavy nuclei ($Z \geq 3$) were detected in the July 18, 1961 solar particle event. This result brings to four the number of solar cosmic ray bursts in which heavy nuclei have been seen. The particles were detected in nuclear emulsions flown on a balloon launched from Fort Churchill shortly after the associated flare appeared on the sun. The average flux of medium nuclei ($6 \leq Z \leq 9$) during the early part of the solar event was 12.0±1.8 particles/m^2/sr sec in the energy interval from 120 to 204 MeV/nucleon, or about 40 times the normal galactic cosmic ray medium nuclei flux at that particular time in the solar cycle. The helium to medium nuclei ratio in the same energy interval was 79±16. These values are consistent with those anticipated on the basis of the relative abundance of hydrogen, helium, and medium nuclei in other events. Some large nuclei ($Z \geq 10$) were detected, but light nuclei were so rare that only an upper limit to their abundance could be set ($L/M \leq .07$). Author

N66-26692*# Naval School of Aviation Medicine, Pensacola, Fla.

RADIATION MONITORING WITH NUCLEAR EMULSIONS ON PROJECT GEMINI. I. EXPERIMENTAL DESIGN AND EVALUATION PROCEDURES: PARTIAL RESULTS ON MISSIONS 4 AND 5

Herman J. Schaefer and Jeremiah J. Sullivan 18 Feb. 1966 17 p refs Joint rept. with NASA

(NASA-CR-75036; NAMI-955) CFSTI: HC $1.00/MF $0.50 CSCL 20H

On Gemini 4 and 5, small packs of nuclear emulsions combined with other radiation sensors to flat pliable units were worn by the astronauts inside their space suits. Track and grain counting of 200 micra Ilford G.5 and K.2 emulsion pairs in the packs furnished the particle and energy spectrum of the radiation incident upon the astronaut's body. Evaluation of flux and energy spectrum in terms of millirad dose showed that the bulk of the exposure was due to trapped protons picked up in the South Atlantic Anomaly. The energy spectrum of the proton flux within the ship on the body of the astronaut is a continuum extending from zero to about 300 Mev, with a broad, well-developed maximum in the 30 to 40 Mev region. Since a large part of the flux is of low penetrating power, the radiation level within the capsule depends on local shield geometry and shows does rate variations at different locations of at least 60 per cent. Representative total doses were 48 millirads on Gemini 4 and 105 millirads on Gemini 5. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N66-25403# Royal Greenwich Observatory, Herstmonceux (England).

REVISED ABUNDANCE ANALYSIS OF THE HALO RED-GIANT HD 122563

B. E. J. Pagel London, HMSO, 1965 33 p refs *Its* Royal Obs. Bull. No.-104

HMSO: 4s

Two major modifications are made in the Wallerstein method for differential curve-of-growth analysis of the halo red-giant star HD 122563. A many-branches solar growth curve is used for Fe I to account for damping constants in different groups of multiplets, and other differential excitation temperature values are used for neutral and ionized lines. A small correction for Rayleigh scattering is included. The iron–hydrogen ratio is found to be lower than in the Sun by a factor between 200 and 600, which differs little from the previous results. Abundance ratios of other elements, particularly heavy metals, appear to be less than found by Wallerstein. The heavy elements formed by the s-process which turn out to be significantly deficient in HD 122563, are those that are enhanced by large factors in CH stars. This suggests that Fe had little chance to be recycled before HD 122563 was formed. The synthesis of Sr, Y, Zn, and Zr must have taken place simultaneously or very shortly after the synthesis of the iron group itself. M.W.R.

N66-25404# Specola Vaticana (Vatican City).

STRUCTURAL DETAIL IN A REGION NEAR THE ANTI-CENTRE

M. F. Mc Carthy and P. J. Treanor 1965 25 p refs *Its* Ric. Astronomiche, Vol. 7, No. 3

CFSTI: HC $1.00/MF $0.50

Objective prism spectra covering a region of 80 square degrees centered near $l^{II} = 180°$, $b^{II} = -10°$ have been obtained with the Vatican Schmidt telescope. The spectra were obtained mainly on 103aE plates through an RG_2 filter, and have a dispersion of 316 A/mm at H_α. H_α emission has been detected in 13 stars (m_v=5.6–11:). Of these, nine are new; they include one K star and a carbon star, and the rest are B_3–A_2 emission stars. No further emission stars were detected in a deeper survey of the richest quadrant of the area studied. A comparison of the surface density of emission stars in this region with that of known emission objects in the same latitude range and within ±30° of galactic longitude reveals a striking observational excess in the region studied. Existing large scale surveys may therefore be very incomplete even to a magnitude limit of m_v=11. The group of emission objects are centered on the area occupied by the galactic clusters NGC 1746 and 1750. Estimates of the mean absorption in this region lead to inferred mean distances for the emission stars and the normal B stars of the order of half a kiloparsec. This agrees with the estimated distance for the cluster NGC 1746. There is no substantial evidence

in the present observations for the extension of spiral structure in this latitude beyond one kiloparsec from the sun. Author

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N66-25443# Royal Greenwich Observatory, Herstmonceux (England).

PROPER MOTIONS IN THE REGION OF THE HYADES

C. A. Murray, C. M. Lowne, and E. D. Clements London, HMSO, 1966 38 p Roy. Obs. Bull. No. 108

HMSO: 5s

The results of a search for members of the Hyades cluster on astrometric plates taken with the Mount Wilson 60-inch and 100-inch reflectors are presented. The survey covers 17.7 square degrees and the average limiting magnitude is about $m_{pg}=15.5$, although a few fields were searched to fainter limits. Criteria for cluster membership are derived. Out of a total of 69 candidates, 21 stars are suspected as being true members; of these, 16 have been noted previously by other investigators. The number of suspected members with $m_{pg}>10$ found in the present survey is in fair agreement with what would have been expected on the basis of Giclas' blink survey, but is considerably in excess of the number of K- and M-type dwarfs predicted by van Bueren. Author

N66-25458# Instituto y Observatorio Astronomico de Marina, San Fernando (Spain).

AERONAUTICAL ALMANAC, JANUARY-APRIL 1966 [ALMANAQUE AERONAUTICO, ENERO-FEBRERO-MARZO-ABRIL, 1966]

1965 274 p In SPANISH CFSTI: HC $6.00/MF $1.50

An aeronautical almanac is presented for January, February, March, and April of 1966. The tables include information on the position of the sun, moon, Venus, Jupiter, Saturn, and Aries as well as the times of rising and setting of the sun and moon at the Greenwich meridian. R.N.A.

N66-25463# Instituto y Observatorio Astronomico de Marina, San Fernando (Spain).

ASTRONOMICAL EPHEMERIS FOR 1966 [EFEMERIDES ASTRONOMICAS AND 1966]

1965 554 p In SPANISH *Its* Vol. 175 CFSTI: HC $8.53/MF $2.75

An astronomical ephemeris is presented for the year 1966. Included are calendars; astronomical events; sidereal and universal time; fundamental units; solar and lunar eclipses; ephemerides of the sun, moon, planets, and planetary satellites; stellar and planetary occultations by the moon; apparent positions of stars; risings and settings of the sun and moon; and other auxiliary tables. Transl. by R.N.A.

N66-25474# Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany). Institut für Extraterrestrische Physik.

EXPLORATION OF THE INTERPLANETARY MEDIUM FROM THE LUNAR AND CISLUNAR SPACE

R.-H. Giese and R. Lüst [1965] 21 p refs Presented at the 16th Intern. Astronautical Congr., Athens, 13-18 Sep. 1965 CFSTI: HC $1.00/MF $0.50

The magnetic field of the moon, a collisionless shock wave, solar wind measurements, the Gegenschein, zodiacal light, and recovery of interplanetary particles are considered in a paper dealing with the exploration of lunar and cislunar space. Various references related to these subjects are discussed in a literature survey of problems related to lunar and interplanetary explorations. M.W.R.

N66-25479# Radio and Space Research Station, Slough (England).

WORLD DATA CENTRE C: ROCKETS AND SATELLITES. LIST OF REPORTS AND REPRINTS RECEIVED DURING THE PERIOD 1 JULY-30 DECEMBER 1965

[1965] 12 p refs CFSTI: HC $1.00/MF $0.50

Reports relating to rocketry, satellites, and space probes which were received by the World Data Center C between July 1 and December 30, 1965, are listed according to subject. Titles and sources are presented for researches dealing with orbits, tracking, data recovery, gravitational and magnetic fields, radiation, the atmosphere, ionospheric radio wave propagation, meteors, biomedicine, astronomy, and plasma physics. M.W.R.

N66-25481# Observatorium Bosscha, Bandung (Indonesia).

THE COLOUR MAGNITUDE DIAGRAM OF THE GALACTIC CLUSTER NGC 6383

Pik-sin The Jun. 1965 12 p refs

(Rept.-32) CFSTI: HC $1.00/MF $0.50

Almost all the stars in a circular area with a radius of about 12 min. of arc, were measured photometrically down to V=13.80 magn. The photographic measurements generally confirm Eggen's remarkable result that NGC 6383 is a very young cluster, similar to NGC 2264. Groups of stars lying on different parts of the colour magnitude diagram of NGC 6383, are discussed in connection with Herbig's idea about non-coevalness of stars in a stellar cluster. Author

N66-25483# Specola Vaticana (Vatican City).

GALACTIC COORDINATES FOR THE STARS IN THE GENERAL CATALOGUE OF RADIAL VELOCITIES

F. C. Bertiau, J. M. Burley, and M. F. Mc Carthy 1965 160 p *Its* Ric. Astronomiche, Vol. 7, No. 2

CFSTI: HC $5.00/MF $1.00

Spectral, kinematical, and positional data provided in tabular form for the brighter stars in the General Catalogue of Radial Velocities (GCRV). Galactic coordinates, with a precision of 0.01°, are presented according to the system adopted in 1960. Basic material for the tables is a tape prepared at the Goddard Space Flight Center from an unverified card version of the catalogue; this tape was subjected to extensive checking. Both equatorial coordinates (prepared in 1950) and the galactic coordinates are included for each GCRV number. M.W.R.

N66-25489# Royal Aircraft Establishment, Farnborough (England).

THE ORBIT OF ARIEL 2 (1964-15A)—THE FIRST TWELVE MONTHS

R. H. Gooding Dec. 1965 54 p refs

(RAE-TR-65274) CFSTI: HC $3.00/MF $0.50

The definitive orbit for Ariel 2 (1964-15A) is computed, from Minitrack observations, for a period of twelve months from the launch of the satellite. The orbit is described by a model with eight orbital parameters and these parameters are listed at every twenty-fifth nodal passage. The angular observations are accurate to about 1' and, as a result, the average computed standard deviations of the eight fitted orbital parameters are as follows: 1 m in semi-major axis, 10^{-5} in eccentricity, 2" in inclination, 4" in right ascension of the node, 30" in argument of perigee, $0^s.03$ in time at the node, and 0.001 deg/d^2 and 0.001 deg/d^3 in the linear and quadratic coefficients occurring in the mean motion polynomial. Ephemerides computed from the listed orbital parameters will be accurate to about 1/2 km, the accuracy required by the Ariel 2 experimenters. Limitations which prevent the accuracy from being better than this are discussed. Author

N66-25491# European Space Vehicle Launcher Development Organization, Paris (France).
ACCURACIES IN A HOHMANN TRANSFER
E. Cambi Mar. 1966 18 p
(ELDO-TM-F-28) CFSTI: HC $1.00/MF $0.50

The influence of the injection errors on the position of the apogee is discussed through an elementary analysis; numerical values are given for a case of technical interest. Author

N66-25522# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RADIO PHYSICS AND ASTRONOMY Semiannual Technical Summary Report, 1 Apr.–30 Sep. 1965
James W. Meyer and Paul B. Sebring 3 Mar. 1966 102 p refs
(Contract AF 19(628)-5167)
(ESD-TDR-65-492; AD-629923) CFSTI: HC $4.00/MF $0.75

Much of the laboratory's general research work in the fields of radio physics and astronomy is done with the facilities and by the staff on the Laboratory's Millstone Hill Field Station. This first issue of the Radio Physics and Astronomy report is intended not only to report our most recent research findings and experiment preparations in these fields, but also to provide sufficient background in our past work to give the reader an overall acquaintanceship with the extent and history of such work at Lincoln Laboratory. Radar measurements on the moon and nearer planets with the Millstone radar are described, as are preparations for similar, more accurate measurements at Haystack Hill. Applications of techniques that were developed for radar astronomy to the improved detection and tracking of artificial satellites are also described. Studies of the electron and ion behavior in the ionosphere continue and the results are being co-ordinated with work elsewhere. Haystack Hill, the newest facility, is still in its early operating phase, with much of the effort of the station complement going into its increasingly complex instrumentation. Author (TAB)

N66-25529*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INJECTION AND MIDCOURSE CORRECTION ANALYSIS FOR THE GALACTIC PROBE
R. T. Groves 24 Jan. 1966 25 p refs
(NASA-TM-X-57511) CFSTI: HC $1.00/MF $0.50 CSCL 22C

The purpose of this paper is to provide information on the effects of injection errors on a galactic probe mission to Jupiter and the ability to correct these errors by performing a single attitude-restricted midcourse correction. Monte Carlo methods have been used with an injection error model and a midcourse correction error model that are assumed to be representative and probably conservative. Threee possible attitude control laws as well as mission objectives are assumed. Numerical results are presented in tabular and graphical form. Authbr

N66-25530*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GALACTIC PROBE TRAJECTORY PARAMETERS: 1969 TO 1972 LAUNCH OPPORTUNITIES
R. E. Coady 17 Feb. 1966 39 p refs
(NASA-TM-X-57510) CFSTI: HC $2.00/MF $0.50 CSCL 22C

Variation of mission parameters with launch date and flight characteristics of a Jovian mission are investigated. Consideration is given to launch opportunities during the following periods: (1) November 1, 1969 to February 28, 1970; (2) December 1, 1970 to March 18, 1971; and (3) January 1 to April 30, 1972. Required injection velocities, injection energies, and corresponding flight times are given as a function of launch date; these parameters are considered fundamental in selecting a launch vehicle and payload for the mission. Geometric relationship between the Sun, probe, and Earth at Jupiter arrival are presented as a function of flight time and launch date. In order to minimize the communications distance at Jupiter arrival, total flight time should be about 500 days. This flight period is considered to eliminate the possibility of communications blackout due to ocultation by the Sun. The galactic probe mission as presently envisioned is thought to be feasible and within the capabilities of the launch vehicles planned for the 1970 to 1974 period. M.W.R.

N66-25545*# Consultants and Designers, Inc., Arlington, Va.
LUNA-10 IN ORBIT AROUND THE MOON [LUNA-10 NA ORBITE VOKRUG LUNY]
11 Apr. 1966 13 p Transl. into ENGLISH from Pravda (Moscow), no. 95, 5 Apr. 1966
(Contract NAS5-9299)
(NASA-CR-74916; ST-PR-LPS-10472) CFSTI: HC $1.00/MF $0.50 CSCL 22A

This report consists of the official Tass communique on Luna 10's orbit around the moon and the Pravda editorial of the same date providing details on the way the lunar orbiting was achieved and giving the various flight parameters. The report ends with general comments on the performance. It is illustrated by sketches and a rear view of the automatic station. Author

N66-25551*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SIMPLIFIED CALCULATION OF TRANSITION MATRICES FOR OPTIMAL NAVIGATION
John S. White Washington, NASA, May 1966 44 p refs
(NASA-TN-D-3446) CFSTI: HC $2.00/MF $0.50 CSCL 17G

This paper presents the results of a study aimed at simplifying the equations used when applying the Kalman filter to space navigation. One frequently used method for generating the transition matrix is to integrate the perturbation equations of motion. An alternate approach considered here generates approximate matrices directly from the gravitational potential. With this scheme, the transition matrices can be generated much more quickly and with smaller computer storage requirements than before. Using these approximate matrices for navigation is equally as good a technique as the original. Author

N66-25553*# TRW Systems, Redondo Beach, Calif.
DEVELOPMENT OF AN ORBIT DETERMINATION PROGRAM TO REGRESS FOR LUNAR POTENTIAL CONSTANTS
F. J. Lombard [1966] 49 p refs
(Contract NAS1-4605-3)
(NASA-CR-66065) CFSTI: HC $2.00/MF $0.50 CSCL 22C

The orbit determination program was modified to regress for lunar constants in a moon centered coordinate system using earth based observations. The program has the capability to solve, and to provide corrected state vectors, for an arbitrary number of lunar potential constants, as well as the usual six orbital parameters. Station location errors and station observational biases may also be included. Two cases cover about 10 hours of tracking on two different trajectories, with the solution vector including 12 potential constants, i.e., the μterm of the moon plus the 11 constants of Goudas' model. The recovered values were found to be consistent with the covariance matrix describing their uncertainties. Two other cases involved a single trajectory. In one case, 11 constants

were perturbed and 7 were included in the solution vector; in the other, the solution vector contained 9 constants. Data arcs of 9 1/2 and 20 hours were used. The recovered values were not consistent with the covariance matrix, particularly in the case for which only 7 constants were solved. D.T.

N66-25554*# TRW Systems, Redondo Beach, Calif.
EVALUATION OF THE USE OF OCCULTATION DATA IN DIFFERENTIAL CORRECTION PROCEDURES FOR DETERMINATION OF THE LUNAR ORBIT
D. H. Lenis [1966] 38 p refs
(Contract NAS1-4605-3)
(NASA-CR-66095) CFSTI: HC $2.00/MF $0.50 CSCL 22C

Occultation times of the earth and sun were investigated as aids to convergence and to reduction of the final uncertainties in the converged result for differential correction of lunar satellite orbits. The earth occultation measurement was assumed to have a standard deviation of 0.5 sec, and the sun occultation, 0.7 sec. These data were not found to be useful as a convergence aid because of extraneous zeros in the occultation function. When large energy errors were present in the initial orbital estimates, the actual occultation time could be closer to an extraneous than to its respective zero, and hence, would result in an inappropriate residual and correction. Thus, occultations were of greatest value when the solution was already closely approximated and when convergence problems were not prevalent. In addition, occultation data of nominal quality were found only to slightly reduce the uncertainties in the coverged vector state when used with the standard observation schedule. Substantial reduction in these uncertainties was obtained, however, for occultation data one order of magnitude better than nominal. When used with very short data arcs, nominal data sufficed. D.T.

N66-25557*# TRW Systems, Redondo Beach, Calif.
MATRIX SENSITIVITY ANALYSIS FOR LUNAR SATELLITE ORBITS
C. B. Sheckells [1966] 181 p
(Contract NAS1-4605-3)
(NASA-CR-66066) CFSTI: HC $5.00/MF $1.25 CSCL 22C

The sensitivities of eight matrices associated with the Lunar Orbiter mission were investigated. The results were obtained, using an inversion error program, by applying to each matrix four perturbations: two random and two bias. It was shown that nearly all of the eight matrices were quite sensitive to errors in the last two significant figures. In addition, the error in a 19×19 double precision covariance matrix was determined. In general, the error was found to be in the 11th or 12th significant figure, or conversely, the matrix was found to be accurate to the 10th or 11th figure. D.T.

N66-25575*# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
INVESTIGATION OF LUNAR SURFACE CHEMICAL CONTAMINATION BY LEM DESCENT ENGINE AND ASSOCIATED EQUIPMENT
A. Buchler, A. Wechsler (Little (Arthur D.), Inc., Cambridge, Mass.), L. Aronowitz, C. Baulknight, F. Koch et al Jan. 1966 64 p refs
(Contract NAS9-4860)
(NASA-CR-65342; RE-237) CFSTI: HC $3.00/MF $0.75 CSCL 22A

An investigation of lunar surface and atmosphere contamination is summarized. Areas of investigation include: composition of inorganic, organic, and bacteriological contaminants; distribution of contamination on the lunar surface contamination of the lunar atmosphere; transient temperature distributions produced by rocket exhaust plume; possible chemical reactions between exhaust products and surface materials; and possible interactions between contaminant molecules and the surface. A set of proposed lunar models which are flexible enough to incorporate many hypothetical details of the lunar surface structure are described, along with methods and devices for minimizing and compensating for contamination. Finally, the Apollo scientific program and the consequences of cumulative contamination are discussed. D.T.

N66-25576*# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
INVESTIGATION OF LUNAR SURFACE CHEMICAL CONTAMINATION BY LEM DESCENT ENGINE AND ASSOCIATED EQUIPMENT Final Report
L. Aronowitz, N. Milford, S. Penn, F. Pomilla, A. Wechsler (Little (Arthur D.), Inc., Cambridge, Mass.), et al Mar. 1966 215 p refs
(Contract NAS9-4860)
(NASA-CR-65341; RE-242) CFSTI: HC $6.00/MF $1.25 CSCL 22A

The composition was studied of inorganic and organic contaminants from the LEM descent engine exhaust and from gas vented from the ascent stage. Means for minimizing and compensating for contamination in samples were surveyed. Contamination due to bacteria and biological debris was examined; and it was concluded that unless specific measures are taken to prevent it, the probability of bacteriological sample contamination approaches 100%. A possible method for minimizing contamination is to collect them from regions that are partially or totally shielded from rocket exhaust gas. The Luna 9 photographs suggest that such regions may exist under rocks or inside cavities that are distant from the LEM touchdown point. Several devices are also suggested for minimizing contamination in samples. These include a sampling probe to be dropped from the LEM before or immediately after touchdown; and an instrument to be used by the astronaut that will decontaminate a portion of the lunar surface, and then take a sample at a sufficient depth below the surface to avoid further contamination. D.T.

N66-25647# Republic Observatory, Johannesburg (South Africa).
REPUBLIC OBSERVATORY CIRCULARS, VOLUME 7, NUMBER 124
1965 24 p CFSTI: HC $1.00/MF $0.50

The data derived from photographic observations of minor planets and comets are presented in tabular form. Micrometer measurements of double stars were made and the data provided include the star's discovery designation, epoch, position angle, separation, and estimated magnitude. Observational data from interferometer measurements of double stars are also provided and include the data, position angle, separation in seconds of arc, estimated difference of magnitude, and an estimate of the quality of the measurements. H.S.W.

N66-25694*# National Aeronautics and Space Administration, Washington, D. C.
RESULTS DERIVED FROM OPTICAL OBSERVATIONS WITH THE SPACECRAFT "VOSKHOD"
K. P. Feoktistov, G. V. Pozenberg, A. B. Sandomirskiy, V. N. Sergeyevich, and D. M. Sonechkin *In its* Space Res. May 1966 p 82-86 (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

A brief summary is presented of some of the optical observations made by the crew during the flight of Voshkod. It was found that the light mist surrounding the earth in the

diurnal hemisphere veils both the Earth's surface at the horizon and the troposphere cloudiness. When the Earth is illuminated by the moon and is close to the horizon, a weak luminescent band, extending along the horizon and clearly distinguishable on the background of the aurora polaris, is observed at the edge of the planet. Two series of photographs were obtained which depict cloudiness on the background of a water surface; one pertains to the periphery of a cyclone, the other to an anticyclone. M.W.R.

N66-25701*# National Aeronautics and Space Administration, Washington, D. C.
ALTITUDINAL-TIME DISTRIBUTION OF THE ELECTRON CONCENTRATION AND NONUNIFORM FORMATIONS OF THE OUTER IONOSPHERE
Ya. L. Al'pert and V. M. Sinel'nikov *In its* Space Res. May 1966 p 166–184 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Electron concentrations determined by a shortened formula are made from data collected by the Elektron I satellite. It is considered possible that the quasi-periodic nature of changes in altitudinal-time distributions of electron density in the outer ionosphere are due to reflecting boundaries caused by plasma oscillations. It is assumed that the altitudinal-time distribution of electron concentration is accompanied by a local disturbance of the balanced Maxwell distribution of electron velocities, as well as by an increase in electron temperatures. Local heating of the plasma as a whole is possible, although the concentration of positive atoms can change very little. The number of nonuniform formations is not the same at different longitudes. Disturbances in electron concentration are observed in many cases in the nonuniformity dimension range, and it is suggested that there may be a specific mechanism in in the excitation of such formations. M.W.R.

N66-25706*# National Aeronautics and Space Administration, Washington, D. C.
THE OUTER REGION OF THE EARTH'S IONOSPHERE (FROM 2000 TO 20,000 km)
V. V. Bezrukikh and K. I. Gringauz *In its* Space Res. May 1966 p 238–248 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Information available on the outer region of the Earth's ionosphere at altitudes from 2000 to 20,000 km is reviewed in a literature survey. Attention is given to charged particle concentrations, the use of ion traps, whistling atmospherics, and the nature of the Earth's plasma envelope. Regarding the latter, which represents the peripheral region of the terrestrial ionosphere, it is concluded that the water molecules entering the upper atmosphere via evaporation from the Pacific Ocean dissociate because of solar ultraviolet radiation. The hydrogen atoms thus formed are ionized by charge exchange with ions of atomic oxygen, and this reaction is intense up to the base of the exosphere whose altitude varies with solar activity. These and other data indicate that the region of the ionosphere considered is almost completely ionized and that neutral particles comprise only a small fraction of the ion concentration. M.W.R.

N66-25708*# National Aeronautics and Space Administration, Washington, D. C.
COMPOSITION OF THE OUTER IONOSPHERE OF THE EARTH BASED ON MEASUREMENT DATA FROM THE "ELEKTRON" SATELLITES
V. G. Istomin *In its* Space Res. May 1966 p 259–272 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

Radio frequency mass spectrometers with variable potential counters were carried on Elektron satellites to measure the composition of the ion composition in the outer ionosphere. Typical spectra of ion masses obtained by Elektron II are graphed at various altitudes from 425 to 1300 km; and ion streams of helium, hydrogen, nitrogen, and oxygen are graphed as a function of time for one satellite revolution. Change in relative concentration of atmospheric ion components are illustrated as a function of altitude over a seven-day period; oxygen and hydrogen ions are found to be the main components at all altitudes, and their concentrations become equal at an altitude of 900 km. Based on these findings a model is presented of the ion composition of the outer ionosphere which differs from most other models in that helium ions are not the predominant ionospheric component at any altitude. M.W.R.

N66-25749*# National Aeronautics and Space Administration, Washington, D. C.
STUDY OF METEORIC MATTER
T. N. Nazarova *In its* Space Res. May 1966 p 763–768 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

This article discusses earth-based, sounding rocket, and satellite measurements of meteoric matter near the earth and in interplanetary space. Results of both Soviet and U.S. measurements are presented and compared. These studies have demonstrated the existence of a dense dust envelope at altitudes of 100–300 km above the earth, that meteoric particle density is subject to fluctuations in time and space, and that there are individual bunchings of particles with nonuniform spatial density whose linear dimensions fluctuate widely, reaching millions of kilometers. R.N.A.

N66-25751*# National Aeronautics and Space Administration, Washington, D. C.
RESULTS OF RADIO EMISSION STRENGTH MEASUREMENTS AT 725 AND 1525 kc BY EQUIPMENT ON THE SATELLITE "ELEKTRON-2"
Ye. A. Benediktov, G. G. Getmantsev, N. A. Mityakov, V. O. Rapoport, Yu. A. Sazonov et al *In its* Space Res. May 1966 p 776–805 refs (See N66-25686 14-13) CFSTI: HC $8.35/MF $4.50

This report presents the results of medium and long wavelength radio emission strength measurements made by Elektron 2. The satellite had an apogee of almost 70,000 km which completely eliminated ionospheric effects on the measurements. The satellite entered the ionsophere during perigee. Based on the variation in the radio emission level received at the output of the receiving equipment, the profiles of electron concentration in the ionosphere were determined in an extensive altitude range. The prolonged operation of the satellite made possible the discovery of sporadic radio emission at the frequencies 725 and 1525 kc. Included are descriptions of the radio receiving equipment, the method of measuring the radio emission strength, and the primary measurement results; and discussions of the frequency intensity spectrum of cosmic radio emission, determining the ionospheric electron concentration profile from cosmic radio emission at 1525 kc, and the sporadic radio emission from the earth's atmosphere. R.N.A.

N66-25779# Carter Observatory, Wellington (New Zealand).
THE EXPLORATION OF THE MOON
I. L. Thomsen 1964 24 p Thomas Cawthron Mem. Lecture no. 39

Pertinent data and other research findings relating to lunar explorations are reviewed in terms of the origin of the moon and its geological characteristics. Actual observations and theoretical conclusions are presented in a historical framework, and the volcanic and meteoric theories of the moon's origin are discussed. M.W.R.

N66-25785*# National Aeronautics and Space Administration, Washington, D. C.
SHORT GLOSSARY OF SPACE TERMS
[1962] 55 p Second Edition
(NASA-SP-1) GPO: HC $0.25; CFSTI: MF $0.50 CSCL 05B

Brief definitions are presented for technical terms frequently used by space technologists in this pocket-size glossary. Definitions are taken from the 1965 edition of the *Dictionary of Technical Terms for Aerospace Use*, but mathematical notations and many details are intentionally omitted in an attempt to provide a nontechnical reference guide. M.W.R.

N66-25794# Royal Aircraft Establishment, Farnborough (England).
SKEW LAUNCH OF A SATELLITE INTO A CIRCULAR ORBIT
G. B. Longden Jan. 1966 103 p refs
(RAE-TR-66007) CFSTI: HC $4.00/MF $0.75

This report considers the problem of launching a satellite into a circular orbit from a launch site which is offset by some angle from the plane of the orbit. All offset angles up to 90° and orbital heights from zero to ten times the launch geocentric radius are considered. Results are obtained for the transfer ellipse, connecting the launch point with the orbit, which reQuires least speed change by the vehicle. The solution ceases to resemble the Hohmann transfer for quite small offset angles. Except in particular circumstances, the best transfer ellipse does not arrive in the orbital plane at apogee, although this approximation demands characteristic speeds up to only 5% greater than the best. Beyond a certain boundary, for large heights and large offset angles, the single elliptical transfer should be replaced by a bi-parabolic transfer. This work is related to similar minimum performance problems which arise in arranging rendezvous between an ascending and target satellites. Author

N66-25818# Belgian Royal Observatory, Uccle.
DETERMINATION OF THE MEAN ANNUAL MOVEMENT OF THE COMPANION OF A VISUAL DOUBLE STAR WHOSE ORBIT IS CALCULATED BY THE THIELE-INNES METHOD. DETERMINATION OF THE VISUAL DOUBLE STAR'S ORBITS BY AN ELECTRONIC ORDINATOR [DETERMINATION DU MOYEN MOUVEMENT ANNUEL DU COMPAGNON D'UNE ETOILE DOUBLE VISUELLE DONT L'ORBITE EST CALCULEE PAR LA METHODE DE THIELE-INNES. DETERMINATION D'ORBITES D'ETOILES DOUBLES VISUELLES A L'AIDE D'UN ORDINATEUR ELECTRONIQUE]

The resolution of the Thiele–Innes system of fundamental motion equations, which are used in the calculation of the elliptical orbit of a visible double star, is examined for two classes of problems. One class is capable of being solved on an ordinary calculator. The other, with the introduction of a few simple formulae, is appropriate for programming on an electronic ordinator. Transl. by D.T.

N66-25902# Boeing Scientific Research Labs., Seattle, Wash.
LUNAR PROFILES DETERMINED FROM ANNULAR SOLAR ECLIPSES OF 1962 AND 1963
M. Davidson (Manchester Univ.), C. L. Goudas, and Z. Kopal Oct. 1965 75 p refs *Its* Mathematical Note No. 428
(D1-82-0470; AD-629882) CFSTI: HC $3.00/MF $0.75

The lunar profile deduced from the 1962 eclipse plates was found to be insufficiently well-defined due to the effects of irradiation. The 1963 eclipse plates were, however, largely free from this defect, and their analysis led to satisfactory results. The outcome of the reductions revealed that the deviations of the lunar profile from a circle were of the form +0 sec.54 sin 2 beta–0 sec.16 cos 2 beta+ 0 sec.27 sin 3 beta–0 sec.05 cos 3 beta 0 sec.16 sin 4 beta + 0 sec.11 cos 4 beta, where beta denotes the lunar position angle measured from the eastern part of the equator in the counterclockwise direction. These deviations were compared with the preceding lunar limb determination and found to be in satisfactory agreement; in particular, they agree within the limits of observational errors with the profiles obtained by Potter (1962) and Watts (1963). The elliptical component of the profile is found to have its major axis inclined by approximately 37 degrees to the lunar axis of rotation—a value which is almost identical with that given by Watts. Author (TAB)

N66-25908# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ORBIT PREDICTION
G. Gebel Apr. 1965 19 p
(Contract NOw-0604-c)
(TG-681; AD-630045) CFSTI: HC $1.60/MF $0.50

The present method of predicting an orbit for the immediate future is described. A mathematical model of the expected along-track errors is proposed and studied to determine how modification of parameters affects orbit prediction.
Author (TAB)

N66-26049# Fordham Univ., New York. Astronomical Lab.
TEN VARIABLE STARS IN THE CYGNUS CLOUD, VV 141–150
Walter J. Miller 24 May 1965 22 p *In* Ric. Astronomiche (Vatican City), v. 7, no. 1, 1965 p 1–20
CFSTI: HC $1.00/MF $0.50

Vatican variables 141–150 include one irregular, one semi-regular, and eight long period variables. Three of the LPV's are known variables whose periods were previously unknown. For long intervals several of the variable stars are invisible on even the best Vatican Observatory plates, and some are barely visible on Palomar Sky Survey plates. The variables were measured on 588 Hamburg Observatory plates at Hamburg–Bergedorf and on 6457 Vatican, Hamburg, Heidelberg, Harvard and Mount Wilson and Palomar Observatory plates at Fordham University. The results are summarized in three tables, and individual light curves are presented for all ten variables on eight pages of illustrations. Author

N66-26054# Konkoly Observatory, Budapest (Hungary).
THE RR LYRAE STARS IN MESSIER 3
B. Szeidl 1965 285 p refs
(Rept.-58) CFSTI: HC $6.00/MF $1.50

This work is a survey of all the measurable RR Lyrae stars in the globular cluster M3. Variables having complicated O–C diagrams exhibit strong light curve changes. The O–C diagrams of RRc stars and irregular RRab stars consist of cycles of different length and amplitude. In the period-amplitude relation for regular stars lying more than 2'.5 outside of the center, the separation of the RRab stars into a short and long period sequence is clearly shown. The same separation is apparent for different parameters of the light curve. RRab stars of the long period sequence show the same characteristics as stars of the short period sequence having period shorter by

0.01. Of the 112 variables investigated, 36 show well pronounced light curve changes. The amplitude versus period relations for field RR Lyrae stars with different spectral index suggests that the long period RRab sequence in globular clusters contains RR Lyrae stars of low metal content, while stars of the short period sequence have a higher metal/H value. The two distinct RRab groups are probably the continuations of the two sequences of red stars on the horizontal branch in the HRD. They may represent stars advancing in opposite directions along the horizontal branch in the course of their evolution. R.N.A.

N66-26055# Academy of Sciences (USSR), Moscow.
LOW THRUST SPACE FLIGHT MECHANICS
G. L. Grodzovsky, Y. N. Ivanov, and V. V. Tokarev [1964] 48 p refs CFSTI: HC $2.00/MF $0.50

The results of more than two hundred investigations in low thrust flight mechanics are summarized. Included are the solutions to problems associated with the selection of optimum weight parameters and the optimum propulsion system control parameters. A determination is made of optimum trajectories for continuously applied propulsive thrust when the weight of the propulsion system is comparable to the launching weight of the vehicle. C.T.C.

N66-26056# Fordham Univ., New York. Astronomical Lab.
ELEVEN VARIABLE STARS IN THE CYGNUS CLOUD, VV 151–161
Walter J. Miller 21 Nov. 1965 24 p ref *In* Ric. Astronomiche (Vatican City), v. 7, no. 4, 1965 p 197–216
CFSTI: HC $1.00/MF $0.50

Vatican variables 151–161 include one unusual classical cepheid whose period seems to be slowly changing, and ten typical Algol eclipsing variables. Three of the latter were typed by Baade as eclipsing variables and were published in 1928, but without identification charts or definitive elements. VV 151–161 were measured on 1526 Hamburg Observatory plates at Hamburg–Bergedorf, and on 8562 Vatican, Hamburg, Heidelberg, Harvard and Mount Wilson and Palomar Observatory plates at Fordham University. The results are summarized in four tables, and mean light curves are presented for all eleven variables on five pages of illustrations. Author

N66-26066# Ohio State Univ. Research Foundation, Columbus.
A REVIEW ON CLOSE SATELLITE THEORY Scientific Report No. 2
Ivan I. Mueller Jun. 1964 68 p refs *Its* Rept.-33
(Contract AF 19(628)-1628)
(AFCRL-64-566(III); AD-605656) CFSTI: HC $3.00/MF $0.75

In an investigation of the motion of an artificial earth satellite, normally we proceed in two steps. First, we start with a simplified case by assuming that the mass distribution of the earth and of the satellite are spherical or what is identical in mechanics that the masses are concentrated in points. In addition, we assume that the motion takes place in a vacuum and that there are no disturbing effects present, due to other celestial bodies or to some physical phenomena. The resulting orbit is called *normal orbit*. Second, we review those factors which deviate from the assumptions above and their effect on the normal organ. The disturbed normal orbit is called perturbed. In this report a review of the closed satellite theory is contemplated and therefore most formulas are presented without proofs. Author

N66-26073# Smithsonian Astrophysical Observatory, Cambridge, Mass.
FLUCTUATIONS AND CORRELATIONS IN THE EXPANDING UNIVERSE
Peter G. Eltgroth 24 Jan. 1966 129 p refs
(SAO Special Rept.-197)

This paper attempts to discover the effects of fluctuations and correlations arising from the forces present in the expanding universe. The gravitational and coulomb forces are most important after the density of the expanding universe falls below nuclear density ($\sim 10^{15}$ g/cm^3). Both forces are considered in the present work. The effects of the gravitational force are treated by considering the two particle correlation function in a gravitating expanding universe. Coulomb forces are considered. Energy fluctuations due to the random distribution of charges in a plasma are calculated. The distribution function for the energy is found and finite results obtained by the use of a cutoff parameter. The physical significance of the cutoff parameter is discussed. Calculations involving energy loss via radiation are given. The energy balance of the universe is discussed and shows how gravitational and coulomb effects many interact and exchange energy. A specific cosmological model provided by Layzer is described. Gravitational and coulomb forces can probably explain some of the astronomical features presently observed in the universe. Numerical results are obtained and compared with observations. Author

N66-26083# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
THE CURRENT STATUS OF SELENODETIC CONTROL SYSTEMS
C. L. Goudas Feb. 1966 16 p refs *Its* Mathematical Note No. 453

A brief discussion of the problems encountered in determining absolute coordinates of lunar formations as well as an evaluation of the current status of control systems is given. It is concluded that a control system with errors not exceeding 0.2″ geocentric in each cordinate is possible. Author

N66-26147*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VISCOUS DAMPING OF ROLL DURING ENTRY OF A MARS ENTRY AND LANDING CAPSULE
Jack E. Marte 1 Apr. 1965 15 p refs
(Contract NAS7-100)
(NASA-CR-74887; JPL-TM-33-20) CFSTI: HC $1.00/MF $0.50 CSCL 22A

An analysis has been made of the viscous damping in roll of two capsule configurations during planetary entry. The analysis extends the incompressible solution of flow over a rotating flat disk to the region behind the bow shock of both a blunt and a hemisphere-cone forebody. The results of a simplified example show the damping to be about 7%, independent of the initial roll rate. A method of integrating the results into the six-degree of freedom program has been developed. Author

N66-26251*# Bellcomm, Inc., Washington, D. C.
A NOTE ON A SOLUTION OF THREE BODY PROBLEM
R. Y. Pei 13 Dec. 1965 13 p ref
(NASA-CR-75076) CFSTI: HC $1.00/MF $0.50 CSCL 03C

The equilateral triangle solution of the three body problem is derived in a simple manner. The geometric properties inherent in such a configuration are discussed. The problem is

pertinent to earth-moon libration point missions that have been suggested for the Apollo Applications Program.

Author

N66-26276*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

DEFINITION OF LATERAL-RANGE AND LIFT-DRAG-RATIO REQUIREMENTS FOR RETURN TO BOTH OPTIMUM AND NONOPTIMUM RECOVERY SITES

Paul F. Holloway and E. Brian Pritchard Washington, NASA, May 1966 39 p refs

(NASA-TR-R-237) CFSTI: HC $2.00/MF $0.50 CSCL 22C

The problem of return from near-earth circular orbits to both optimum and non-optimum recovery sites has been analyzed in detail in terms of lateral-range-angle and lift-drag-ratio requirements. A technique of analysis has been developed which permits the rapid determination of the variation of the lateral-range angle with time for a given set of mission constraints (recovery-site latitude and longitude and orbit inclination) through the application of a single equation. The lateral range is defined as the latitude of a given recovery site referred to the orbital plane of a spacecraft. In particular, the equation for lateral-range angle has been applied with the necessary restrictions to define the optimum location of one, two, three, or four recovery sites and the maximum lateral-range-angle requirements necessary to reach these recovery sites for a range of orbit inclinations from −90° to 90°. The lift-drag ratio required to reach the recovery networks has been determined as a function of the lateral-range angle. The effects of wait time in orbit on the lateral-range-angle and lift-drag-ratio requirements are presented for optimum recovery sites for both quick return (return during any orbit) and for return after a preselected number of delay orbits. Also, the increase in lateral-range angle required as a result of deviations from the optimum latitude location is included. Author

N66-26308# Air Force Systems Command, Wright-Patterson AFB, Ohio. Systems Engineering Group.

A STUDY OF THE EFFECT OF MAN'S MOTION ON THE ATTITUDE AND ORBITAL MOTION OF A SATELLITE

Corrado R. Poli Dec. 1965 147 p refs

(SEG-TR-65-41; AD-630890) CFSTI: HC $14.60/MF $1.00

A mathematical model is developed and used for investigating the effects of man's motion on the attitude and orbital motion of an earth satellite. The model is obtained by writing the translational and rotational equations of motion for a rigid-body vehicle containing interconnected moving parts and then reducing these equations to a system consisting of a rigid-body satellite and a point mass man. For the particular portion of the model concerned with the perturbations in the satellite attitude, the equations obtained are found to be independent of the orbit of the vehicle. The solution to the system of equations is primarily restricted to the case determining the disturbance of a given satellite due to an astronaut walking on the surface. It is shown here that the disturbance of the attitude, due to man's motion, is of greater importance than the disturbance due to gravity gradient while the disturbance of the satellite orbit is of the same order of magnitude as that due to the oblateness of the earth. Except for some special cases which contain closed form solutions. The general equations are solved on an analog computer. In all cases studied, the magnitude of the constraint force between the astronaut and the spacecraft is seen to be small. However, the changes in the angular velocity and attitude of the vehicle are shown to be significant. Unlike the attitude of the vehicle, the orbit of the center of mass of the satellite is found not to be seriously affected by man's motion. Author (TAB)

N66-26322# Lockheed-California Co., Burbank.

ASTRODYNAMIC CONSTANTS ANALYSIS Final Report, 12 Sep. 1963–11 May 1966

Samuel Herrick 31 Jan. 1966 135 p refs

(Contract AF 19(628)-3820)

(LR-19480; AFCRL-66-129; AD-630642) CFSTI: HC $4.00/MF $1.00

In the field of astrodynamics the numerical values of various physical constants are required with the greatest precision possible. The report explains that generally the most desirable units for astrodynamical work are different from those used in the laboratory and rely heavily on astronomical observations. Furthermore, there is much interdependency among them complicated by accidental and unknown systematic errors. By employing statistical methods the accidental errors are reduced and the use of metastatistics reduces the effects of the unknown systematic errors. These techniques are applied to presently available data to establish the best values of various gravitational, geodetic and related constants. The report also recognizes the fact that none of the constants are definitive, but subject to further improvement in the future.

Author (TAB)

N66-26454# California Univ., Livermore. Lawrence Radiation Lab.

THE EFFECT OF THE PLANETARY SYSTEM ON THE NEARLY-PARABOLIC COMETS

Joseph L. Brady 6 Jan. 1965 12 p refs

(Contract W-7405-ENG-48)

(UCRL-12267) CFSTI: HC $1.00/MF $0.50

The total effect of the planetary perturbations on the eccentricity of 30 nearly-parabolic comets is obtained by integrating from oscillation backward to the year 1800 and forward to the year 2000. Twenty-three of these 30 comets, over 75% of them, pick up energy and show an increased eccentricity after passing through the planetary system. After enough passes through the planetary system apparently all these comets will attain hyperbolic velocity and be ejected.

Author (NSA)

N66-26501# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A RED BEAM IN THE BLACK SKY

V. Chernyshev 1 Feb. 1966 10 p Transl. into ENGLISH from Krasnaya Zvezda (Moscow), 14 Mar. 1965 p 1

(FTD-TT-65-1683/1+4; AD-629473) CFSTI: HC $1.10/MF $0.50

The importance and applications of the ruby laser in transmitting information through space is briefly reviewed. The dimensions of the laser are indicated. Some problems connected with the use of a very narrow beam in locating an object in space are outlined. It is pointed out that Doppler shifts, relative rates of motion of objects, and spacecraft velocity and direction can be measured with great accuracy using lasers.

N.E.N.

N66-26535# London Univ. (England). King's Coll.

INTERNATIONAL CONFERENCE ON RELATIVISTIC THEORIES OF GRAVITATION, VOLUME II

Jul. 1965 151 p refs Conf. held 1–10 Jul. 1965

(Grant AF-EOAR-21-65)

(ARL-66-0033; AD-626885) CFSTI: HC $14.70/MF $1.00

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14. GROUP THEORETICAL APPROACH TO SPINORS IN THE EINSTEIN THEORY OF GRAVITATION V. I. Ogievetsky and I. V. Polubarinov (Joint Inst. for Nucl. Res., Dubna, U.S.S.R.) 6 p refs

15. DERIVATION OF EXACT EINSTEIN EQUATIONS IN FLAT SPACE V. I. Ogievetsky and I. V. Polubalinov (Joint Inst. for Nucl. Res., Dubna, U.S.S.R.) 9 p refs

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17. SOME CONSEQUENCES OF THE HYPOTHESIS OF NEGATIVE MASS Ya. P. Terletsky (Moscow Univ., U.S.S.R.) 2 p refs

18. ASPECTS OF NEGATIVE MASS AND THE QUASARS Banesh Hoffmann (Queens Coll. of the City Univ. of New York) 3 p refs

19. AXIOMATIZATION OF THE PROPERTIES OF THE SPACE-TIME IN G.R.T. Yr. S. Vladimirov (Moscow State Univ., U.S.S.R.) 3 p

20. NEW ELECTROMAGNETIC RECOIL EFFECT O. Costa de Beauregard (Inst. Henri Poincare, Paris) 1 p refs

N66-26551*# National Aerospace Education Council, Washington, D. C.

AEROSPACE BIBLIOGRAPHY, THIRD EDITION

[1966] 68 p refs

(EP-35) GPO: HC $0.50; CFSTI: MF $0.75 CSCL 22A

An annotated bibliography is presented to assist the general reader and the teacher in locating books, teaching aids, films and filmstrips on space flight subjects. For the most part, the books listed are written for the nonspecialist; however, a few semi-technical titles have been included for readers who wish to delve more deeply into specific space flight subjects. The bibliography also includes: listings of pertinent references; teaching aids such as pamphlets, booklets, charts, and pictures; and a list of space periodicals. Additionally lists of sources of information on specific space subjects available from aerospace industry companies are included. H.S.W.

N66-26555*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

RANGER IX PHOTOGRAPHS OF THE MOON, CAMERAS "A", "B", AND "P"

Washington, NASA, 1966 193 p refs

(NASA-SP-112) GPO: HC $6.50; CFSTI: MF $1.25 CSCL 22A

Ranger IX was directed toward the crater Alphonsus on the moon's surface. The photographs resulting from this mission are presented in this atlas. Ranger IX's B camera provided coverage of the rilles and craters near the east wall, while the A camera covered the western side of the crater and the central peak. The mission, trajectory, target selection, and camera terminal alignment are described, and the spacecraft's television system is discussed. For photograph interpretation studies, a table of values is provided and the parameters listed in this table are defined. H.S.W.

N66-26682# Hull Univ. (England). Dept. of Applied Physics.

SOLAR SYSTEM SPECTROPHOTOMETRY: DESIGN CONSIDERATIONS FOR A MULTIPLEX DISPERSIVE INFRARED SPECTROMETER Annual Summary Report, 1 Nov. 1963–31 Dec. 1964

J. F. Grainger [1964] 45 p refs

(Contract AF 61(052)-751)

(AFCRL-66-110; AD-631045) CFSTI: HC $4.60/MF $0.50

The problems of observing the near infrared spectrum of Venus, using a twelve inch balloon-borne telescope, are assessed. Considerations of the integrated signals available in the desired resolved width of approx. 0.1 microns in the wavelength region visible to 3 microns, show the need for multiplexing. Spectrometric systems of this type are discussed and a dispersive spectrometer using a multi-channel coded disc in the emergent focal plane is shown to possess certain advantages over the others in this type of problem. Author (TAB)

N66-26742# Coimbra Univ. (Portugal). Observatorio Astronomico.

ASTRONOMICAL TABLES FOR THE YEAR 1965 [EFEMERIDES ASTRONOMICAS PARO O ANO DE 1965]

1965 246 p In PORTUGUESE

CFSTI: HC $6.00/MF $1.50

This document constitutes an astronomical ephemeris for the year 1965. Included are general astronomical constants; general data and positions of the sun, moon, and the principal planets; positions of stars for determining local time; tables for computing precession, nutation, aberration, etc.; eclipses of the sun, moon, and satellites of Jupiter; and other auxiliary tables. R.N.A.

N66-26855*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON THE ORIGIN OF STRUCTURE IN THE UNIVERSE

E. R. Harrison May 1966 37 p refs Presented at the 14th Intern. Astrophys. Symp. on Gravitational Instability and the Formation of Stars and Galactic Structures, Liege, Belgium, Jun. 1966 Submitted for Publication

(NASA-TM-X-55491; X-640-66-233) CFSTI: HC $2.00/MF $0.50 CSCL 03C

Cosmology is confronted with the problem of explaining how large-scale structures originated in the universe. Within the framework of conventional theory two hypotheses are possible. In the *primordial structure hypothesis* structural differentiation of a rudimentary form is inlaid within the universe from its earliest moments, whereas in the *instability*

hypothesis structure evolves naturally from small initial disturbances. It is known that according to linearized gravitational theory, small disturbances in an expanding universe grow extremely slowly. This theory is outlined and furthermore it is shown that large structures are unlikely to form as the result of thermal instabilities. Thus, the instability hypothesis is in serious difficulty and it is proposed that we should re-examine the primordial structure hypothesis. One possibility is that differentiation into structural domains is a natural state of matter at very high densities during the earliest stage of expansion of the universe. Author

N66-26864# Space Technology Labs., Inc., Redondo Beach, Calif. Space Flight Analysis Section.
ANALYTIC EPHEMERIS GENERATION FOR SATELLITE MOTION ABOUT AN OBLATE PLANET FOR LOW AND MODERATE ECCENTRICITIES
D. S. Ingram 3 Feb. 1966 43 p refs
(TR-9883.5-101)

Mathematical formulas for an analytic ephemeris generator are developed. The formulas are applicable to orbits of low and moderate eccentricity about an oblate planet. Periodic terms of $O(eJ_2)$ and secular terms of $O(e^2J_2)$ are included, and the case of eccentricity identically zero is not excluded. The results are compared numerically with the general tracking program, which is a numerically integrated program, and a less accurate analytic ephemeris generator which is accurate to $O(J_2)$ in the periodic terms and $O(e^2J_2)$ in the secular terms. Author

N66-26871*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ENGINEERING MODELS OF THE MARTIAN ATMOSPHERE AND SURFACE
D. F. Spencer 1 Jul. 1965 33 p refs
(Contract NAS7-100)
(NASA-CR-75236; JPL-TM-33-234) CFSTI: HC $2.00/MF $0.50 CSCL 03B

Engineering models of the Martian atmosphere and surface are developed for application purposes in designing a Mars capsule/lander. Models are presented for various surface pressures and a number of low-altitude and stratospheric temperature profiles. An atmospheric surface pressure of 14 mb is suggested for design use. Mean continuous wind velocities of approximately 100 ft/sec at the surface are recommended, with a mean vertical gradient of plus 2 ft/sec/1000 ft. A peak design wind velocity of 330 ft/sec is recommended consistent with a 14-mb surface pressure. Models of Mars' surface are developed for the bright areas and the dark areas. The most significant differences in design requirements for these areas result from: (1) The convex and concave low-scale surface contours in the dark areas, and (2) Design requirement to accommodate 10-cm rocks in the dark areas. Author

N66-26874*# Little (Arthur D.), Inc., Cambridge, Mass.
FAR INFRARED SPECTRA OF SILICATE MINERALS FOR USE IN REMOTE SENSING OF LUNAR AND PLANETARY SURFACES Final Report, Apr. 1965–Apr. 1966
James R. Aronson, Alfred G. Emslie, Ronald V. Allen, and Hugh G. Mc Linden 15 Apr. 1966 76 p refs
(Contract NAS8-20122)
(NASA-CR-75289; C-67323) CFSTI: HC $3.00/MF $0.75 CSCL 03B

This report is concerned with the results of an experimental and theoretical investigation of the far infrared spectra of silicate minerals for use in remote sensing of the composition of lunar or planetary surfaces. The subject matter consists of: (1) an examination of the spectral information that may be obtained from silicate minerals in the far infrared region; (2) a study of the effects of the state of surface aggregation, especially for fine particulate surfaces, on the information content of such spectra; (3) considerations of the ways in which the spectra of composite samples may be understood in terms of the spectra of their components, and (4) a brief description of the instrumental considerations that would be involved in utilizing these results on a space mission. Author

N66-26882*# Little (Arthur D.), Inc., Cambridge, Mass.
STUDY OF CRYOGENIC STORAGE ON THE MOON
Peter E. Glaser, Peter F. Strong, Frank Gabron, and Carol H. Sox Dec. 1965 114 p refs *Its* Rept.-66563
(Contract NAS8-11377)
(NAS-CR-75267) CFSTI: HC $4.00/MF $0.75 CSCL 22A

Research on the analysis of the storage problems anticipated in maintaining cryogenic fluids on the surface of the moon in a liquid phase for an extended period of time are reported. Tank supports, the performance of highly effective thermal insulations, and the treatment of piping penetrations to reduce performance degradation are discussed. Analyses of the heat exchange and the computation of environment heat fluxes are presented, and the expected boil-off rate for a specific cryogenic tank design is estimated. Lunar environmental data is reviewed including the atmosphere, surface, solar radiation, and their effects on storage vessels. N.E.N.

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N66-25421# Royal Aircraft Establishment, Farnborough (England).
A VOLTAGE CONTROLLED OSCILLATOR FOR THE UK-3 SATELLITE TELEMETRY
W. H. E. Hampton Dec. 1965 26 p refs
(RAE-TR-65293) CFSTI: HC $2.00/MF $0.50

A voltage-controlled oscillator for the UK-3 satellite is described. The circuit is based on that used by the National Aeronautics and Space Administration organization for UK-3. The factors which affect the input sensitivity and frequency stability are indicated. The changes made to the original circuit used in UK-2 are described, together with methods for increasing reliability by the use of planar transistors throughout. Author

N66-25435# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
SMALL HYBRID ROCKET PROBES FOLLOWING AN OPTIMUM OR QUASI-OPTIMUM TRAJECTORY [PETITES FUSEES SONDES A LITHERGOL, A TRAJECTOIRES OPTIMALES ET QUASI-OPTIMALES]
Pierre Duben 1965 54 p refs In FRENCH; ENGLISH summary
(TN-1965-86) CFSTI: HC $3.00/MF $0.50

Designing a small hybrid rocket for the particular specifications of various aerospace probing programs is interesting because it must be designed to provide the economy and the reliability characterizing assembly line production. The general

theory of optimization of maximum altitude of a payload shows that this single-stage rocket must be equipped with a programmed thrust system varying over a large range and thus justifying the use of a standard hybrid rocket. For some usual missions there is advantage in using a simplified version with no movable part, giving 11 g, about at lift-off, being cheap to make, reliable and using short-length launchers. Such a rocket would combine optimum performance with no important sensitivity to external parameters variations like in any missile built according to a law of thrust evolution nonspecifically adaptable. For an initial weight of 75 kg at lift-off, a payload of 5 kg, and a diameter of 0.16 m, the maximum altitude is 100 km. This allows meteorological probing to an altitude of 80 km at the minimum. Author

N66-25512# Air Force Systems Command, Wright-Patterson AFB, Ohio. AF Flight Dynamics Lab.
X-20 WINDOW TESTS Final Report, Feb.–Apr. 1965
Murray N. England Jan. 1966 39 p ref
(AFFDL-TR-65-211; AD-630469) CFSTI: HC $3.60/MF $0.50

This report describes two structural integrity tests of the X-20A high temperature side window. One test simulated the air leakage from the window during boost and the second test simulated the thermal cycle experienced during reentry. The outside window panel failed prematurely during the thermal cycle, apparently the result of excessive thermal gradients through the frame and a stress concentration caused by thermistor instrumentation leads passing through the frame and under the window seals. Author (TAB)

N66-25549*# National Aeronautics and Space Administration, Washington, D. C.
COMMUNICATIONS SATELLITES Bibliography, Feb. 1965–Jan. 1966
May 1966 85 p refs
(NASA-SP-7004(02)) CFSTI: HC $1.00/MF $0.75 CSCL 22B

An annotated bibliography on communications satellites is presented with abstracts, and author and subject indexes. Such diverse topics are referenced as: television broadcasting, telemetry, outer-space systems, multi-station systems, and medium height random orbit systems. The economic and legal implications of communications satellites are represented. References are also included which describe the history and operation of individual satellites as Advent, Courier, Echo, Relay, Score, Syncom, and Telstar, and well as several satellites used for meteorological studies. D.T.

N66-25569# Sandia Corp., Albuquerque, N. Mex.
NITEHAWK 9
W. C. Womack Jan. 1966 89 p refs Supersedes SC-DR-65-456)
(SC-DR-65-456A; SC-DR-65-456)

The design objectives, system description, tests and results, and development history of the Nitehawk 9 are reported. Thirty-one units gave coning data. Eight exceeded a ±5 degree requirement for oscillation, a low frequency (25 to 50 second period), and extremely low energy oscillation or coning motion which would have gone unnoticed except for a special attitude reference system. Combined with knowledge of antenna patterns also gained from the program, this oscillation was valuable in that it explained several baffling instrumentation problems occurring in various other sounding rocket systems as well as the Nitehawk 9 system. A survey of the experiments to be flown shows that 95 percent will not be affected by the extra-atmospheric coning. Author

N66-25626# Weapons Research Establishment, Salisbury (Australia).
AN ANALYSIS OF THE DISPERSION OF THE SKYLARK VEHICLE—FOR ALL FIRINGS UP TO 30TH SEPTEMBER 1964
D. G. Merchant and J. F. Teague Feb. 1966 31 p refs
(WRE-TN-HSA-110) CFSTI: HC $2.00/MF $0.50

Dispersion data from 52 Skylark trials are collected to complete the analysis of the first 100 trials of this type of vehicle. The standard deviations and means are determined for boosted and unboosted vehicles and compared with previous results. It is concluded that the random errors have increased with time particularly in the downrange direction and that bias errors are barely significant. The behaviour of the launcher rail assembly, and the variation of rocket motor characteristics from those predicted, are suspected as being the two major factors in this trend of increased dispersion. Author

N66-25657# Radio and Space Research Station, Slough (England).
CATALOGUE OF DATA RECEIVED BETWEEN JULY 1ST 1964–DECEMBER 31ST 1965. WORLD DATA CENTRE C—ROCKETS & SATELLITES
[1965] 84 p
CFSTI: HC $3.00/MF $0.75

A summary of rocketry data is provided which includes the name of the rocket, the launch date, and the country in which the observations originated. Positional observations of various earth satellites are cataloged to identify the satellite, the country in which the observation originated, and the period of the observation. Publications are also listed in which data reports of the meteorological rocket network may be found. H.S.W.

N66-25857# RAND Corp., Santa Monica, Calif.
THE EFFECT OF MAINTAINABILITY ON THE MISSION RELIABILITY OF TWO-ELEMENT REDUNDANT SPACECRAFT SUBSYSTEMS
C. G. Vandervoort Dec. 1965 61 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4824-PR; AD-627602) CFSTI: HC $3.00/MF $0.75

The memorandum presents a technique that will assist the designer in assessing the effect of maintenance on the reliability of spacecraft systems with two-element redundancy, i.e., where the prime system element is backed up by a redundant secondary. TAB

N66-25959# Army Missile Command, Huntsville, Ala. Research Branch.
STERILIZATION OF UNMANNED PLANETARY SPACECRAFT
John E. Terry Nov. 1965 35 p refs
(RSIC-490; AD-478321)

This report presents a brief summary of the results of recent studies conducted on spacecraft sterilization. A recapitulation of the advantages and disadvantages offered by various sterilizing agents and methods is included. Also included are clean room requirements and concepts, personnel requirements for sterile vehicle assembly, concepts for the sterilization canister, handling and transportation requirements for the spacecraft and bus, concepts for terminal heat sterilization, and the potential contamination problems existing as the lander separates from the bus. Author (TAB)

N66-26145# Joint Publications Research Service, Washington, D. C.
SELECTION OF THE PARAMETERS OF A MULTISTAGE ROCKET

R. A. Kolchanov *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 166–172 refs (See N66-26126 14-01) CFSTI: $3.00

A solution is proposed to the problem of selecting the fuel supply and thrust of the engine for each stage so as to provide the maximum payload of a multistage rocket in vertical flight in a homogeneous gravitational field. The structural factors of each stage and the exhaust velocity are designated, with consideration given to the weight of the i-th subrocket, the weight of the fuel of the i-th stage, the dry weight of the i-th stage, and the payload weight. A numerical method for solving the problem is detailed. M.G.J.

N66-26146*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

SURVEYOR FOLLOW-ON STUDY SCIENTIFIC OBJECTIVES. PHASE I: SIGNIFICANCE OF A SUCCESSFUL SURVEYOR BLOCK 1 LANDING

James R. Clark, Allan C. Dunk, Seymour M. Horowitz, Dennis H. Le Croissette, and Elliot M. Silverstein 1 Dec. 1964 72 p refs

(Contract NAS7-100)

(NASA-CR-74886; JPL-TM-33-192) CFSTI: HC $3.00/MF $0.75 CSCL 22B

This report discusses the scientific information about the lunar surface and the lunar properties that may be extracted from the engineering data received from the Surveyor block 1 spacecraft. Sensors on the spacecraft which are possible scientific information sources are listed and discussed. References to the data transmission modes are made and brief descriptions of the sensors, components, or subsystems are given where necessary. The way in which the scientific information is extracted from the data is briefly considered. The approach and landing phase of the Surveyor spacecraft will provide some information on surface hardness, bearing strength, and surface friction of the Moon at the landing point. Continuous operation of the spacecraft on the Moon will give some information on lunar thermal properties, dust and micrometeoritic impact. Author

N66-26253*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SATELLITE SITUATION REPORT, VOL. 6, NO. 8, APRIL 30, 1966

30 Apr. 1966 28 p

(NASA-TM-X-57554) CFSTI: HC $2.00/MF $0.50 CSCL 22B

Objects in orbit, as of 30 April 1966, are listed with the following information: code name, catalogue number, source, launch date, period (in minutes), inclination, apogee and perigee (in kilometers), and transmitting frequency. In addition lists are included of objects which decayed, and objects which were both launched and decayed during the period 16 April through 30 April 1966. D.T.

N66-26256*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

VOYAGER PROJECT Progress Report, Mar. 16–Apr. 15, 1966

1 May 1966 46 p

(NASA-CR-75023; VPPR-15) CFSTI: HC $2.00/MF $0.50 CSCL 22A

Continuing developments in planning and design are reported. The control room construction was completed. The first draft of the configuration management handbook was distributed for review. Negotiations with contractors are mentioned. Breadboard constructions were completed and tested, including those of the attitude control triple redundant circuits and of the power supply for the high impact traveling wave amplifier. The status of the telecommunications, guidance and control, propulsion, and power systems and the ballistic range program are given. The final planning for the wind tunnel tests was completed. N.E.N.

N66-26284*# General Electric Co., Philadelphia, Pa. Missile and Space Div.

GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE Second Quarterly Progress Report, 1 Oct.-31 Dec. 1964

10 Jan. 1965 517 p refs

(Contract NAS5-9042)

(NASA-CR-75009; Doc.-65SD4201) CFSTI: HC $8.16/MF $2.50 CSCL 22B

The capability of the proposed gravity gradient system mathematical model is compared with the current GAPS III Program. Computer runs show the effect on performance of various disturbances. Studies made include computer runs comparing the performance of eddy current damping with hysteresis damping, isolated effect of boom thermal bending, capture studies, and attitude error sensing analysis. Items investigated in the primary boom subsystem include lubricant selection, relative rod length and the advantage of shunt wound motors for scissoring and boom extension. Electrical isolation of the booms from their supporting structure was investigated; and functions have been assigned for the microswitches used throughout the boom subsystems. Laboratory tests were conducted on diamagnetic torsional restraint, eddy current and hysteresis damping, and torsion wire suspension. A report on the rf attitude sensor is included. Author

N66-26284*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

APPLICATION OF GROUND TEST ACOUSTIC SIMULATIONS OF LIFTOFF AND TRANSONIC VIBRATION TO ACTUAL RANGER FLIGHT VIBRATION DATA

Marc C. Trummel 1 May 1966 23 p refs

(Contract NAS7-100)

(NASA-CR-75150; JPL-TR-32-910) CFSTI: HC $1.00/MF $0.50 CSCL 22B

During the Ranger flight program, only a limited amount of in-flight vibration data was obtained. In order to expand the usefulness of this data, a ground test was conducted in which a large number of vibration and acoustic measurements were made. The test approximated, by the use of acoustic fields, the vibration excitation mechanisms existing at the flight periods of maximum vibration; liftoff and transonic. By using the ground test data in conjunction with the flight data, the following results were achieved: (1) The nature of the vibration caused by the two excitation modes was determined and the effect of flight accelerometer characteristics on measured vibration was analyzed. (2) A method of predicting flight vibration levels was developed and, by comparison with the actual flight data, was shown to be adequate at higher frequencies, but overly conservative at lower frequencies. (3) The flight vibration environment at the Ranger spacecraft feet and at two general classes of equipment locations on the spacecraft was estimated and shown to be adequately covered by Author

N66-26310# Atlantic Research Corp., Alexandria, Va.

DEVELOPMENT OF THE FRANGIBLE ARCAS METEOROLOGICAL ROCKET VEHICLE Final Scientific Report, Apr. 1964–Dec. 1965

George K. Oss 15 Feb. 1966 157 p

(Contract AF 19(628)-4033)

(ARC-TROL-8895; AFCRL-66-157; AD-630932) CFSTI: HC $24.30/MF $1.25

Development of the Frangible ARCAS vehicle was successfully completed and demonstrated during this program. Two of seven static tests completed during this program, designated Phase II, included successful fragmentation of the spent rocket motor assembly to particle sizes yielding kinetic impact energy levels less than 3.0 ft-lbs. Further analysis showed that maximum energy levels of 1.5 ft-lbs. could be achieved with the existing configuration with only minor modification of the nozzle section. Four flight tests were conducted during the program, two of which included all systems. The initial tests established the flight temperature environment experienced by the explosive fragmentation system. The first systems flight was considered a No Test because of a malfunction induced by the government modified launcher. The final flight test successfully demonstrated vehicle performance, payload ejection at apogee and subsequent vehicle fragmentation as programmed. This flight test fulfilled the primary objective of the program by demonstrating the feasibility of a frangible meteorological rocket system. Author (TAB)

N66-26550*# Ling-Temco-Vought, Inc., Dallas, Tex.
ELECTROSTATIC MEASUREMENT EXPERIMENT, SCOUT VEHICLE 131-R (S.E.V.)
P. E. Greer Washington, NASA, Jun. 1966 41 p refs
(Contract NAS1-3657)
(NASA-CR-477) CFSTI: HC $2.00/MF $0.50 CSCL 22B

Electrostatic sensors were developed, installed, and flown on Scout Vehicle 131R to experimentally evaluate vehicle electrification due to electrostatic charging. The major charge buildup was found to occur during the burning of the main booster engines. Brief background information followed by a detailed discussion on the experimental results are presented. Further electrostatic studies and experimentation are recommended. Author

N66-26552*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FLIGHT REPORT: INTERPLANETARY MONITORING PLATFORM IMP-II (EXPLORER XXI)
Frank A. Carr Washington, NASA, Jun. 1966 29 p refs
(NASA-TN-D-3353) CFSTI: HC $2.00/MF $0.50 CSCL 22B

IMP II was launched on October 3, 1964 from Cape Kennedy, Florida, by the Delta 26* LAUNCH vehicle. The apogee achieved was 51,600 n.m., which was less than one-half of the planned altitude. This problem was attributed to the suspected failure of the igniter assembly of the third-stage motor, occurring after about 16 seconds of normal burning. The angle between the spacecraft spin-axis and the ecliptic plane was reduced by the third-stage malfunction, resulting in a wider range of incident sun-angles during the satellite lifetime. This caused low power output from the solar paddles and over-heating of the silver-cadmium battery. Spacecraft performance was satisfactory until the +50°C temperature environment (about two months after launch) caused the failure of the battery. Thereafter, the spacecraft operated only during periods of favorable incident sun-angles. In all, about five months of useful data was recorded. As of mid-1965, the spacecraft was operating intermittently with essentially no useful data being obtained. There is some possibility that perhaps as much as a month's more data might be obtained in the future. Author

N66-26689*# Boeing Co., Seattle, Wash.
A SYSTEM STUDY OF A MANNED ORBITAL TELESCOPE
Nov. 1965 387 p refs
(Contract NAS1-3968)
(NASA-CR-66047; D2-84042-1) CFSTI: HC $7.00/MF $2.00 CSCL 22B

A summary is presented of the investigations conducted to establish the feasibility of designing, fabricating, launching, and operating a manned astronomical observatory. The basic optical configuration selected was a Cassegrainian type, with two alternate secondary mirrors and two flat folding mirrors. The primary structural design was based on the boost condition. Structural concepts and materials, however, were employed to optimize the four requirements of structural stiffness, thermal isolation, optical alignment, and stress level. Mirror temperature gradients were determined for the finite differences solution of time dependent heat transfer problems. Results indicated that no objectionable gradients would occur if the telescope doors were closed when the telescope would be viewing earth. Some special problems which would require further investigations are discussed, including manufacture of the primary mirror and the investigation of its long term stability; attitude stability and control; and radiation protection of the more sensitive films. These and other factors in the study are discussed in detail and design drawings of resulting concepts are included. General conclusions indicated that the manned orbital telescope is feasible and that the soft gimbal operational concept is preferred. H.S.W.

N66-26701*# System Sciences Corp., Falls Church, Va.
EXPLORER XXIX (GEOS A) POSTLAUNCH PERFORMANCE EVALUATION
J. R. Fischel Mar. 1966 53 p refs *Its* Tech. Memo.-4007-6
(Contract NASw-1238)
(NASA-CR-75069) CFSTI: HC $3.00/MF $0.50 CSCL 22B

An evaluation of the performance of the Explorer XXIX (GEOS A) spacecraft during its first three months in orbit is presented, and the effect of its performance on the geodetic observations are examined. This evaluation covers the injection into orbit after launch, gravity gradient capture, tests with the injection of flashing light information into the memory in the spacecraft, operational readiness tests, and the operational performance of the spacecraft subsystems. A description of GEOS A is given and schematic diagrams of the spacecraft's configuration are provided. An operational summary is included and the following conclusions were drawn from this summary. The apogee of the spacecraft's orbit is higher than planned, and this factor will significantly affect proposed scientific investigations. The spacecraft gravity gradient stabilization subsystem is working well, and the inversion maneuver to achieve proper orientation was successfully performed. The degradation of the performance of the optical and memory subsystems caused difficulties with the investigations, however useful optical data were obtained. The R&RR and SECOR transponders experienced thermal excursions beyond design limits during full sunlight orbits, and the command and telemetry subsystems function satisfactorily. An analysis of these conclusions was conducted and recommendations are given. H.S.W.

N66-26746*# Radio Corp. of America, Princeton, N. J. Astro-Electronics Div.
SPACECRAFT DESIGN DATA INFORMATION SYSTEM Final Report

L. Rosenberg, R. Morton, and R. Morgan 15 Apr. 1966 81 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951335)
(NASA-CR-75180; AED-R-2946) CFSTI: HC $3.00/MF $0.75 CSCL 22B

It is reported that all major project objectives were attained. The format and content requirements are summarized. Indices and book configuration are defined to the level required for a workable system. Typical data sheets are included. The data source, book format and indexing system, data sheet preparation, and system developments are summarized. It is concluded that the spacecraft design data information system has proven feasible. It is pointed out that sufficient data are in hand to prepare data sheets for 12 programs in addition to TIROS, Nimbus, and OGO, and that data sheet preparation can be started for several other programs. The major problem is identified as the acquisition of source data. As the project progresses and data sheets become available, it is expected that the data retrieval task will be simplified. N.E.N.

N66-26748*# Radio Corp. of America, Princeton, N. J. Astro-Electronics Div.
DESIGN REPORT FOR THE TIROS OPERATIONAL SATELLITE (TOS) SYSTEM
30 Dec. 1964 433 p refs
(Contract NAS5-3173)
(NASA-CR-75197; AED-R-2489) CFSTI: HC $7.33/MF $2.25 CSCL 22B

The design report for converting the TIROS OT-2 spacecraft from the standard axial camera configuration to a wheel mode configuration, for use in the first TIROS operation satellite system is presented. Two wheel mode configurations are covered: one with two fully redundant automatic picture transmission systems, and the other with two fully redundant advanced vidicon camera system. A system description, orbital characteristics, OT-2 spacecraft design, ground station equipment, analysis of doubling video subcarrier, radiation analysis, thermal analysis, and a comparative study on the use of integrated circuitry versus conventional circuitry for the command and control subsystem are discussed. Diagrams of circuitry and orbital configurations, graphs of test data, and flow charts are included. N.E.N.

N66-26754*# Exotech, Inc., Alexandria, Va.
ON THE FEASIBILITY OF RADIATION STERILIZATION OF PLANETARY SPACECRAFT Final Report
Matthew J. Barrett and William C. Cooley 2 May 1966 141 p refs
(Contract NASw-130)
(NASA-CR-75187; TR-012) CFSTI: HC $4.00/MF $1.00 CSCL 22B

It is shown that unmanned planetary landing capsules can be sterilized by high energy X-rays or gamma rays with a dose of 5 megarads. X-rays from a 3 to 10 MeV electron accelerator are preferred for a large (2500 lb.) capsule, because of penetration requirements, but Cobalt-60 gamma rays can be used on small capsules, such as a 100 lb. Mars atmospheric probe. The most critical radiation-sensitive components are transistors which are subject to damage by surface effects and permanent degradation of current gain. There is reason to believe that a capsule sterilized by radiation can be made more reliable than one sterilized by heat. Also, sterility assurance can be improved by avoiding the necessity to vent and refill the gas as is planned for a capsule which is heat sterilized. By a lowering of the dose requirement, the radiation damage effect can be reduced below the levels discussed in this report. It appears that 5 megarads may be a higher dose than required for planetary quarantine requirements. At a lower dose, near 1 megarad, radiation damage would become a much less difficult problem. Author

N66-26755*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE SITUATION REPORT, VOLUME 6, NO. 6
31 Mar. 1966 69 p
(NASA-TM-X-57542; X-512-66-51) CFSTI: HC $3.00/MF $0.75 CSCL 22B

A complete list is presented of objects in space as of 31 March 1966. Such information is included as: code name, catalogue number, source, launch date, period (in minutes) inclination, apogee and perigee (in kilometers), and transmitting frequency. Also presented is a list of objects which have decayed during the period 1 December 1957 to 31 March 1966, with the following information: code name, catalogue number, source, and launch and decay dates. D.T.

N66-26765*# Radio Corp. of America, Princeton, N. J. Astro-Electronics Div.
TIROS X METEOROLOGICAL SATELLITE SYSTEM, VOLUME I Final Engineering Report
14 Jan. 1966 164 p
(Contract NAS5-3173)
(NASA-CR-75257; AED-R-2801) CFSTI: HC $5.00/MF $1.00 CSCL 22B

Component design and mission modifications for the reconfiguration of TIROS X to suit the requirements of a near-polar, sun-synchronous orbit are described. The reconfiguration was based on the utilization of two axial-mounted standard TIROS cameras, the addition of a quarter orbit magnetic attitude control system, and the minimization of additional modifications. The launch and orbit considerations, and the camera and photocoverage for the new orbit are given in detail. The revised satellite component design and testing are presented. Brief functional descriptions of those spacecraft subsystems and subsystem elements which are essentially the same as on previous TIROS satellites are included. N.E.N.

N66-26819*# Perkin-Elmer Corp., Norwalk, Conn. Electro-Optical Div.
PRINCETON ADVANCED SATELLITE STUDY, VOLUME I Final Summary Report, 8 Mar. 1965-15 May 1966
[1966] 40 p Prepared for Princeton Univ. Obs. /its Rept.-8346(I)
(Grant NGR-31-001-044)
(NASA-CR-75299) CFSTI: HC $2.00/MF $0.50 CSCL 22B

A summary is given of a program for studying general problems of large high resolution optical instruments with apertures between 30" and 120" diameter in space. Also studied were specific problems associated with a high resolution, ultraviolet spectrometer, imaging telescope of 40" diameter aperture on board an OAO. The study resulted in a concept for a telescope magnetically suspended inside an OAO spacecraft which can be used for high resolution (0.1 Å) spectral investigations down to approximately 1000 Å wavelength, and high resolution star imagery with close to diffraction-limited performance. Included are investigations of the use of an Apollo extension system in combination with the OAO spacecraft equipped with the high resolution instrument. C.T.C.

N66-26820*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
THE AEROELASTIC CHARACTERISTICS OF THE SATURN-IB AND SATURN-V LAUNCH VEHICLES
Mar. 1965 79 p refs
(Contract NAS8-11238)
(NASA-CR-75301; M-37-65-1) CFSTI: HC $3.00/MF $0.75 CSCL 22D

The effects of flow separation on the aeroelastic characteristics of the Saturn-IB and Saturn-V launch vehicles with an Apollo payload have been investigated. The steady and unsteady aerodynamic loads over these vehicles are dominated by separated flow. The results of a single-degree-of-freedom, quasi-steady analysis of the first three, free-free, body bending modes indicate that both vehicles are aerodynamically damped over the high-dynamic-pressure portions of their trajectories ($0.8 \leq M \leq 2.0$). Thus, one can conclude that both vehicles will be aerodynamically damped over the entire ascent Mach-number range. Author

N66-26823*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SATURN S-II MANUFACTURING ENGINEERING WORKING GROUP MEETING NUMBER FIVE—MSFC PROGRAM
E. J. Minter et al [1963] 174 p Meeting held at Huntsville, Ala., 25-27 Jun. 1963
(NASA-TM-X-57581) CSCL 22D

CONTENTS:
1. COMPONENT CLEANING AS A PART OF CONTAMINATION CONTROL E. J. Minter 55 p
2. PROPOSED S-IC STRUCTURAL ALIGNMENT J. Franklin 15 p
3. TIG WELDING PROGRESS R. Hoppes 21 p
4. ELECTRON BEAM WELDING G. Parks, R. Schwinghamer, and M Brennecke 25 p
5. MANUFACTURING OF SATURN ELECTRICAL CABLES (FLIGHT) K. C. Byram 51 p

N66-26847*#
A SYSTEM STUDY OF A MANNED ORBITAL TELESCOPE—SYNCHRONOUS ORBIT STUDY
Apr. 1966 316 p refs
(Contract NAS1-3968)
(NASA-CR-66102; D2-84042-2) CFSTI: HC $7.00/MF $1.75 CSCL 22A

A study was conducted on operating a 120-inch telescope in a 28.5 degree inclined 24-hour synchronous orbit with a 28.5 degree inclined 250-nautical mile orbit. Comparisons of observation time, stability and control, thermal distortion, radiation and micrometeoroids, and costs are made. The study contion and micrometeoroids, and costs are made. The study concluded that the Manned Orbital Telescope operating in a synchronous orbit will have considerable advantages with respect to observation time and thermal stability, but the logistics costs will increase. Author

N66-26848*# National Aeronautics and Space Administration, Washington, D. C.
EXPLORER XXIX (THE GEODETIC EXPLORER)
[1966] 12 p
(NASA Facts, Vol. III, No. 4) CFSTI: HC $1.00/MF $0.50 CSCL 22B

The geodetic satellite, Explorer XXIX, and its purpose, equipment, gravity gradient stabilization system, ground facilities, and launch vehicle are described. R.N.A.

N66-26867*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DYNAMIC ENVIRONMENT OF THE RANGER SPACECRAFT: (I THROUGH IX) Final Report
David B. Wiksten 1 May 1966 73 p refs
(Contract NAS7-100)
(NASA-CR-75273; JPL-TR-32-909) CFSTI: HC $3.00/MF $0.75 CSCL 22B

The dynamic environment of the Ranger spacecraft (I through IX) during the launch portion of flight is defined. Flight data from each of nine spacecraft launches have been reviewed and are included. The environments receiving emphasis herein include liftoff acoustics, liftoff and transonic vibration, and the transient vibrations of the various pyrotechnic and staging events in the launch sequence. The systems for data acquisition and analysis are briefly described. In addition, postflight comparison of flight data and ground test specification levels is made, and the dynamic test program is briefly discussed. Author

N66-26872*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SEMIANNUAL REVIEW OF RESEARCH AND ADVANCED DEVELOPMENT, JULY 1, 1965 TO DECEMBER 31, 1965. VOLUME II: SUPPORTING RESEARCH AND TECHNOLOGY FOR THE OFFICE OF ADVANCED RESEARCH AND TECHNOLOGY NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
31 Jan. 1966 452 p refs
(Contract NAS7-100)
(NASA-CR-75276; JPL-TM-33-272, Vol. II) CFSTI: HC $7.51/MF $2.00 CSCL 22B

The objectives are given and the progress is reported for all supporting research and technology. The areas of investigation include: (1) nuclear propulsion systems; (2) space power; (4) space vehicle systems; (4) electronics systems; (5) communication systems and apparatus; (6) human factors system; (7) chemical propulsion; and (8) chemical rocket experimental engineering. D.T.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N66-25424# Centre de Recherches et d'Essais de Chatou (France).
STABILITY OF FLEXIBLE BURIED PIPES [STABILITE DES TUYAUX SOUPLES ENTERRES]
Luong Minh Phong Jul. 1965 145 p refs In FRENCH /ts Bull. No. 12
CFSTI: HC $4.00/MF $1.00

The general behavior of the lining of a subterranean tunnel, and the influence of the various parameters on the critical pressures supported by the walls were investigated. Calculations and measurements show an equilization of forces about the tunnel due to the mutual adjustments of the earth and the lining. This equalization justifies the hypothesis of a uniform force distribution. The lining stability was studied in terms of elastically supported ring structures in order to determine the role of the surrounding earth in the interplay of forces which

support and bear down upon the tunnel. Destruction mechanisms were also studied to establish general equations for rigid, semi-rigid, and flexible linings. These equations permit the calculation for any form of lining under any load configuration, and furnish the basis for a general theory of the stability of large interred walls. Transl. by D.T.

N66-25425# United Kingdom Atomic Energy Authority, Harwell (England). Research Group.
STRAINS DUE TO MAGNETOSTRICTIVE SURFACE FILM
J. Woodrow 1966 22 p refs
(AERE-M-1698)

A magnetostrictive layer is deposited on a plastic sheet under a saturated magnetic field parallel to the sheet. The magnetization in a small circular region is then rotated through a right angle about the normal to the sheet. The plane and bending strain distributions inside and outside the circular region due to magnetostriction are determined. The analysis shows that in one particular case of a cobalt film deposited on P.V.C., the strain at the surface of the cobalt film in the circular region is 0.371 of the saturated magnetostrictive strain. Author

N66-25444# Chalmers Univ. of Technology, Goteborg (Sweden).
RESISTANCE TO THERMAL STRESSES IN SOME TYPES OF WHITE-WARE
Folke Sandford and Berne Liljegren 1965 46 p refs *Its* Trans. No. 296 Inst. för Silikatkemisk Forskning 48
CFSTI: HC $2.00/MF $0.50

Unglazed bodies of feldspar porcelain, bone china, vitreous china, earthenware, clayware, oven-proof and flame-proof ware were investigated with reference to some of the most important physical properties and the connection of these properties with the resistance of the body to thermal stresses. The resistance of the various types of bodies to thermal stresses was determined with reference to constant temperature gradient, spot cooling shock, spot heating shock and total cooling shock according to the "dipping test". The thermal expansion coefficient of a dense/vitreous body proved to have a regular connection with the resistance of the body to thermal stress as determined by the "dipping test". Otherwise, it was not possible to find any simple relationship between the resistance of the body to thermal stresses and the rest of its physical characteristics, its microstructure of the pore system and its contents of glass phase. Author

N66-25506# Pennsylvania Military Coll., Chester.
A SHORT SURVEY OF VISCOELASTIC THEORY
R. A. Di Taranto 15 Jan. 1966 41 p refs
(Contract N161-26236)
(MEL-37/66; AD-629785) CFSTI: HC $2.00/MF $0.50

A short survey of viscoelastic theory is presented as a background for the structurally inclined engineer in this field. The elementary Maxwell and Kelvin–Voigt models are considered and the response of these models to specific strain and stress excitations is given. Also presented are the mathematical interrelations among the viscoelastic material characteristics such as relaxation function, storage modulus, loss modulus, tangent loss factor, storage compliance and loss compliance, relaxation function and retardation function. Consideration is given to the effect of temperature on the characteristics of a thermorheologically simple viscoelastic material as well as the testing procedures in the different frequency and time ranges. Author (TAB)

N66-25607# Marine Engineering Lab., Annapolis, Md.
THE CRITICAL DAMPING CALCULATOR AND THE EVALUATION OF MEASURING SYSTEMS TO DETERMINE DAMPING PROPERTIES OF STRUCTURES
Bruce E. Douglas and C. S. Longley Mar. 1966 21 p refs
(MEL-98/66; AD-630433) CFSTI: HC $1.00/MF $0.50

An analysis of existing experimental methods for measuring damping properties of structures revealed measurement limitations not previously reported. A new experimental approach, the critical damping calculator developed by MEL, is compared with previously used measurement systems and with theoretical results. Deficiencies in all the reported methods (Free decay and the various impedance methods) are discussed, and a range of accuracy is determined and tabulated. The critical damping calculator was found to give relatively accurate results over a broad measurement range where a combination of the other measurement systems would be necessary to obtain the same accuracy. Author (TAB)

N66-25667# David Taylor Model Basin, Washington, D. C.
ELASTIC MATERIAL CONSTANTS OF FILAMENT-WOUND CYLINDERS FABRICATED FROM E-HTS/E787 AND S-HTS/E787 PREPREG ROVINGS
Kenneth Hom, William P. Couch, and Abner R. Willner Feb. 1966 28 p refs
(DTMB-1823; AD-630318) CFSTI: HC $2.00/MF $0.50

The elastic material constants of filament-wound, glass-reinforced-plastic cylinders fabricated from E-HTS/E787 and S-HTS/E787 preimpregnated rovings were experimentally determined for the case of plane stress. Cylinders with a 3.2-in. diameter were stressed under unidirectional loadings and the strains were measured to determine the elastic moduli and Poisson's ratios. The engineering elastic constants were then used to predict the measured strains of the 3.2-in.-diameter cylinders and also 6-in.-diameter cylinders subjected to biaxial (hydrostatic pressure) loading. The measured strains compared favorably with prediction. Author (TAB)

N66-25674# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Flight Dynamics Lab.
DEVELOPMENT TEST SUMMARY IN SUPPORT OF X-20 ELEVON STRUCTURAL TEST PROGRAM Final Report, Jan.–Jul. 1964
John C. Grogan Jan. 1966 31 p
(AFFDL-TR-65-191; AD-630463) CFSTI: HC $2.00/MF $0.50

The contents of this report are oriented exclusively toward test procedures, test hardware and test techniques involving advanced type structures. It contains a general summary of significant results obtained during the development test program conducted in preparation for the X-20 Elevon Structural Test Program. Author (TAB)

N66-25755 Oklahoma State Univ., Stillwater.
APPLIED STRESS ANALYSES OF PRESSURIZED CYLINDERS
Robert E. Little and Cemil Bagci Mar. 1965 104 p refs *Its* Eng. Res. Bull.
(Publ.-145)

Stress analysis of hydraulic cylinders, e.g., (1) detailed treatment of the Lame solution, (2) analysis of the stress concentration effect of a hole in the cylinder wall, and (3) examination of the effect of nonuniform wall thickness. In each case the significant results are presented in graphical form. Author

N66-25799# Institut Franco-Allemand de Recherches, St. Louis (France).
BEHAVIOR AND SIMULATION CHAMBER FOR SHOCK LOADS [CHAMBRE DE SIMULATION ET COMPORTEMENT AU SOUFFLE DE STRUCTURES]
C. Thery, J. Pierron, and G. Gerspacher 24 Feb. 1964 29 p In FRENCH
(ISL-T-4/64) CFSTI: HC $2.00/MF $0.50

The chamber and its performance characteristics are described. In addition, the experiments performed with the chamber are briefly reviewed. Some results are presented in tabular form, and photographs of the various test apparatuses and the chamber are included. D.T.

N66-25806# Lund Inst. of Tech. (Sweden).
STRUCTURAL FIRE ENGINEERING RESEARCH TODAY AND TOMORROW
Ove Pettersson Stockholm, Roy. Swed. Acad. of Eng. Sci., 1965 36 p refs Prepared in cooperation with Natl. Swed. Inst. for Mater. Testing
(Ci-33) CFSTI: HC $3.00/MF $0.75

The designing of load bearing structures of structural members with reference to their fire resistance is discussed. Standard temperature–time curves used in several countries are included. Full scale and model fire tests are described, and the temperature–time curves are examined. The strength and deformation properties of structural materials are investigated at temperatures associated with fires. Graphs are presented showing the temperature effects on stress–strain, tensile strength, elongation, compressive strength, and modulus of elasticity. Temperature fields and load-bearing capacity connected with structures exposed to fires are calculated, and the theoretical results are given in graph form for steel, concrete, and timber structures. It is felt that information available today affords a highly inadequate basis for reliable fire engineering design, and emphasis is placed on the importance of rapid and intensive research work in structural fire engineering. N.E.N.

N66-25809# Chalmers Univ. of Technology, Goteborg (Sweden).
NEW FACETS OF RESEARCH ON KAM STEEL BARS [NYA RON BETRAFFANDE ANVANDNINGEN AV KAMJARN]
Hjalmar Granholm 1965 40 p refs In SWEDISH; ENGLISH summary *Its* Trans. No. 305
CFSTI: HC $2.00/MF $0.50

The application of deformed steel as material for reinforcing concrete is discussed. Straight reinforcing bars without any bends are recommended for the main reinforcement. The bars may be either inclined or vertical, but inclined stirrups are preferred since they eliminate the effect of the inner level arm. Grouping the bars closely together, in cross sections having a high percentage of reinforcement, facilitates the placing of concrete. The modulus of relative deplacement is defined, which makes possible the determination of the actual value of the bond stresses in pull-out tests and in beam tests. A cold worked steel was found to resist stresses of 4000 to 5000 kg/cm^2 in cross sections with a high percentage of reinforcement, without any inconvenient crack formation. This steel was considered well suited for prefabrication. N.E.N.

N66-25810# Royal Military Coll. of Canada, Kingston (Ontario). Dept. of Civil Engineering.
ULTIMATE CAPACITY OF STEEL COLUMNS LOADED BIAXIALLY
11 Mar. 1966 48 p refs
CFSTI: HC $2.00/MF $0.50

A theoretical prediction of the ultimate capacity of columns loaded biaxially was undertaken. Theoretical and experimental curves for uniaxial bending are graphed. An extension to three dimensions, of the overlapping shape criterion used to find the ultimate capacity of a column loaded in a single plane, was investigated. The configuration of elemental lengths, and column shapes are discussed. Diagrams and tables of the Euler's length–resultant moment relation are given. Predicted data for nine different combinations of loading and geometry are presented. Experiments were performed to test the validity of the theory and predictions. Each section of thin walled, square tubing was subjected to a compression test. The modulus of elasticity and the lower yield stress in compression were determined. Experimental procedures are detailed. The theoretical requirements for length, eccentricity, and load were calculated. A close correspondence of measured with predicted loads at ultimate capacity was found for the three cases investigated. N.E.N.

N66-25814# United Kingdom Atomic Energy Authority, Risley (England).
AN EXPERIMENTAL STUDY OF THE FAILURE STRENGTH OF FLAWED STEEL PLATES
A. Quirk, T. C. Finnear, G. D. Fearnehough, and R. W. Nichols (U.K. Atomic Energy Authority, Culcheth) 1966 27 p refs (TRG-1086(C))

The results of tensile tests on flawed wide steel plates are reported. The plates were, in general, 7 ft wide and 4 ft long, and flaws of 12 to 36 inches in length were investigated. Detailed consideration of the failure stress results revealed a number of features which did not appear consistent with other work. An experimental stress analysis on one specimen showed that these inconsistencies were due to the distribution of the applied load along the specimen. When the load was distributed uniformly across the specimen the results agreed very closely with the results of similar tests carried out on 5 ft dia. vessels. Author

N66-25824# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Mulheim an der Ruhr (West Germany).
ON THE PREBUCKLING STATE AND THE STABILITY BEHAVIOR OF THIN-WALLED CONICAL SHELLS UNDER AXISYMMETRIC BOUNDARY CONDITIONS [SPANNUNGS- UND STABILITATSUNTERSUCHUNGEN AN DUNNANDIGEN KEGELSCHALEN BEI AXIALSYMMETRISCHEN RANDBEDINGUNGEN]
Klaus Schiffner Apr. 1966 82 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-24; DVL-508) CFSTI: HC $3.00/MF $0.75

The prebuckling state of thin walled isotropic and orthotropic conical shells under axisymmetric loads is investigated applying a nonlinear shell theory. The system of ordinary nonlinear differential equations is solved by a difference method with approximation of higher order. For isotropic conical shells an exact solution for the linearized system can be obtained. The calculation of buckling loads leads to an eigenvalue problem which is also solved iteratively by the difference method. The influence of shell parameters and of an axisymmetric predeformation on the buckling load is discussed. The results are in good agreement with the experiments, particularly for a conical shell under axial load and high internal pressure. Author

N66-25834# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
AN "OPTIMAL" SOLUTION OF SAINT-VENANT'S FLEXURE PROBLEM FOR A CIRCULAR CYLINDER

David B. Bogy Feb. 1966 41 p refs
(Contract Nonr-220(58))
(TR-4; AD-630290) CFSTI: HC $4.60/MF $0.50

In a recent paper Sternberg and Knowles established certain minimum strain-energy properties of Saint-Venant's solutions to the relaxed Saint-Venant problem for an elastic cylinder. They proved that Saint-Venant's solutions for the case of extension, pure bending, and torsion are uniquely distinguished, among all solutions to the appropriate relaxed problem that correspond to a fixed resultant load and to pointwise vanishing shearing or normal terminal tractions, by the fact that they minimize the total strain energy. In the same paper Saint-Venant's solution for the case of bending by transverse terminal loads was shown to be no longer optimal in the foregoing sense and the optimal flexure solution was characterized implicity as the solution to a mixed–mixed boundary-value problem for the cylinder in question. In the present investigation this optimal flexure solution is determined explicitly for a circular cylinder by means of the Papkovich–Neuber stress functions. The results obtained, which are in infinite-series form, are evaluated numerically and compared with the analogous results of Saint-Venant. The solution deduced here also supplies a quantitative illustration of Saint-Venant's principle. Author (TAB)

N66-25883# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
A CORRESPONDENCE PRINCIPLE FOR FREE VIBRATIONS OF A VISCOELASTIC SOLID
George M. C. Fisher and Marshall J. Leitman Aug. 1965 15 p refs
(Contract Nonr-562(40))
(TR-1; AD-630486) CFSTI: HC $1.00/MF $0.50

A correspondence principle was established for free vibrations in the classical linearized theory of viscoelasticity. It was shown that for motions which are either irrotational or solenoidal there is always an associated elastic problem with the following properties: (1) every mode shape for the viscoelastic problem is also a mode shape for the elastic problem and (2) the viscoelastic frequencies can, in principle, be calculated from a knowledge of the elastic spectrum and the relevant relaxation function. It was also shown that, in general, for motions which are neither irrotational nor solenoidal, this correspondence exists only for a restricted class of viscoelastic materials. Author (TAB)

N66-25901# Pennsylvania State Univ., University Park. Ordnance Research Lab.
LOCAL AND BENDING STRESSES IN LAYERED MATERIALS WITH BONDED INTERFACE
B. L. Chapman (M.S. Thesis) 10 Nov. 1965 104 p refs
(Contract NOw-65-0123-d)
(TM-619-3111-06; AD-629898) CFSTI: HC $4.00/MF $0.75

The objective of this thesis was to obtain quantitative stress data for layered materials with bonded interface subjected to a static point load. Two distinct cases were considered: (1) local stresses due to a concentrated load applied to a semi-infinite composite body, and (2) bending stresses due to a point load applied to a composite beam whose vertical boundaries were fixed. A theoretical solution employing methods of numerical analysis where the composite is considered as a discrete continuum, and an experimental solution utilizing the technique of both photoelasticity and the moire method, resulted in compatible stress levels. Only stresses in the lower or core layer were considered. Variations in the stress level due to changes in material for the upper layer and thickness of the protective layer were examined. Author (TAB)

N66-25915# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOLVING THE PROBLEM OF A SYMMETRICALLY DEFORMED CONICAL SHELL OF LINEARLY VARIABLE THICKNESS ON THE ELECTRONIC MACHINE "STRILLA"
Y. M. Grigorenko and N. O. Lobkova 1 Feb. 1966 11 p refs Transl. into ENGLISH from Prikl. Mekhan. (Moscow), v. 8, no. 2, 1960 p 224–228
(FTD-TT-65-1375/1+2+4; AD-630413) CFSTI: HC $1.60/MF $0.50

An algorithm was written for obtaining numerical solutions of a symmetrically deformed conical shell under axial stress using a digital computer. The stressed state of the shell is described by a system of two second order, ordinary differential equations. D.T.

N66-25956# Oklahoma Univ., Norman. Graduate Coll.
UNSYMMETRIC FREE VIBRATIONS OF SANDWICH SHELLS OF REVOLUTION
Merle Dean Bacon (Ph.D. Thesis) 1965 188 p refs
(Contract AF 33(608)-1096)
(AD-478402)

Contents: Survey of Developments in the Analysis of Vibrational Characteristics of Thin Elastic Shells; Formulation of the Strain and Kinetic Energy Expressions for a Circular Conical Shell; Application of Rayleigh–Ritz Method; Application to Specific Problems. TAB

N66-26069# Lockheed Missiles and Space Co., Sunnyvale, Calif.
PARAMETRIC VIBRATIONS OF A CYLINDRICAL SHELL CONTAINING A PULSING FLUID FLOW IN THE MIDDLE LAYER
V. V. Stepaniuk [1966] 6 p refs Transl. into ENGLISH from Prikl. Mekhan. i Tekhn. Fiz (USSR), v. 2, no. 2, 1966 p 130–135

This paper investigates the vibrations of a cylindrical structurally orthotropic sandwich shell of finite length, with an ideal incompressible flow of variable velocity within its middle layer. The possibility of the origin of parametric resonance is shown, and formulas are obtained to determine the boundaries of the first two instability domains of the shell motion. R.N.A.

N66-26072# All American Engineering Co., Wilmington, Del.
DESIGN, DEVELOPMENT, AND EVALUATION OF A CRASH-RESISTANT FUEL SYSTEM INSTALLATION
W. Buckson, W. Schlegel, and I. R. Smith Washington, FAA, Dec. 1965 110 p refs
(Contract FA-WA-4580)
(FAA-ADS-27)

A crash-resistant fuel system, utilizing high-strength bladder fuel cells, breakaway fittings, crash-load-actuated shut-off valves, and fiber glass protective liners, was designed and installed in the center section of a DC-7 aircraft wing. A jet-propelled car was used to accelerate the wing mounted on a dolly to predetermined velocities prior to engaging a decelerator. There were no failures in either standard or crash-resistant fuel (CRF) system fuel cells and no inadvertent valve closures in the CRF system during the tests. Hydraulic loads were nominal and were not additive from one cell to another through interconnections. A final destructive test was conducted wherein the wing, at a velocity of 77 knots, engaged two stationary vertical poles, positioned to shear the wing panels at the outboard nacelles. It was demonstrated that with a more positive means of triggering shut-off valves, the CRF

system has a potential for greater chances of fuel containment, with consequently less fire hazard, in case of survivable crashes. Author

N66-26120*# Minnesota Univ., Minneapolis.
THEORETICAL CONSIDERATION OF THE INFLUENCE OF REFORMING PROCESSES ON THE FRACTURE STRENGTH OF SOLIDS Technical Report No. 105
H. H. Kausch von Schmeling, S. R. Moghe, and C. C. Hsiao Mar. 1966 18 p refs
(Grant NGR-24-005-070)
(NASA-CR-75083) CFSTI: HC $1.00/MF $0.50 CSCL 20K

The macroscopic strength of an oriented medium is investigated under the assumption that processes of breaking and reforming of microscopic components in the medium may occur. The differential equation governing the time dependent variation of the number of load carrying components is considered. Emphasis is placed on the study of the effect of the reformation processes on the stress time-to-fracture behavior. It is suggested that under small loads these processes may be responsible for the frequently observed phenomena of the deviation from linearity of the strength and logarithm of time-to-fracture relationship. An attempt is also made to compare theoretical results with some reported experimental data. Author

N66-26121*# Minnesota Univ., Minneapolis.
ANISOTROPIC RELAXATION FUNCTIONS AND STRENGTH OF ORIENTED SOLIDS Technical Report No. 106
S. R. Moghe and C. C. Hsiao Mar. 1966 22 p refs
(Grant NGR-24-005-070)
(NASA-CR-75082) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Mechanical properties of a solid are formulated in terms of microscopic behavior as a result of deformation and orientation. The relaxation behavior of the oriented solid is obtained by considering statistically the viscoelastic micro behaviors. It is found that various anisotropic relaxation functions can be expressed as a single time-dependent function under certain conditions. The time-dependent macroscopic fracture strength is also analyzed for the oriented system using known results for a completely oriented system. Author

N66-26131# Joint Publications Research Service, Washington, D. C.
AXIALLY SYMMETRICAL OSCILLATIONS OF A SPHERICAL SHELL FILLED WITH FLUID
A. M. Anisimov *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 33-39 refs (See N66-26126 14-01) CFSTI: $3.00

Explanations are given for the solution of the problems in determining the frequencies and forms of the proper oscillations of a thin and hollow spherical shell filled with a fluid. A final-difference method of the solution is developed and the results are given of the calculation of the frequency and form of the first tone of the oscillations as a spherical shell entirely filled with a fluid when 2R/d=1.5. Author

N66-26132# Joint Publications Research Service, Washington, D. C.
THE CARRYING POWER OF FRAMEWORK THIN-WALLED ROUND CYLINDRICAL SHELLS UNDER COMPRESSION
S. N. Kan and D. Ye. Lipovskiy *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 40-51 refs (See N66-26126 14-01) CFSTI: $3.00

A comparatively simple method is developed for calculating the carrying power of framework thin-walled round cylindrical shells under compression. The initial camber is considered as the most essential factor affecting the carrying power; a structurally orthotropic shell is used as the calculation diagram. Equations are derived for axially symmetric deformations, and for deformations that are not axially symmetric. Calculation methods are given, which are associated with the necessity of estimating the amplitude magnitude of the initial camber near the critical harmonic. M.G.J.

N66-26133# Joint Publications Research Service, Washington, D. C.
ON THE CALCULATION OF THE STABILITY OF FLAT PLATES
A. V. Sachenkov *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 52-58 refs (See N66-26126 14-01) CFSTI: $3.00

Certain problems in the stability of flat plates within the limits of elasticity are studied. An analogy is established for the problem of the stability of a plate uniformly compressed, mounted in a hinged support along its edges, with the well-studied problem of the free oscillations of a flat membrane. Multiple formulas are derived for calculation of the stability of plates having various outlines. A solution is given for the problem of the shear resistance of an annular plate, mounted in hinged supports holding it along the edges and being pinched. Author

N66-26167# Chalmers Univ. of Technology, Goteborg (Sweden).
FUNCTIONS SIMPLIFYING THE USE OF LEVY'S PLATE SOLUTION
Bengt A. Akesson 1965 162 p refs *Its* Trans. No. 301 CFSTI: HC $5.00/MF $1.00

This paper investigates functions which simplify the use of Levy's plate solution. A class of real functions, termed S-functions, is defined by an infinite series of function of two real variables. Properties of the S-functions that are of interest in the plate analysis are studied. Functions called U- and V-functions, which consist of algebraic sums of S-functions, are introduced. The classical Levy solution is applied to a simply supported infinite plate strip subjected to a transverse line load, a moment line load, a transverse strip load, and a moment strip load. The solutions obtained contain the Fourier sine series coefficients of the load intensity as free parameters. Levy solutions are given for eight types of loads upon the infinite plate strip. The advantage of using S-functions in the plate analysis is discussed. Practical calculations using the tables of S-functions are presented. A computer program is described and the manual calculations of a numerical application are presented. An approximate solution is given for loaded infinite plate strips whose edges are eigher rigidly or elastically buit in. The usefulness of S-functions in beam theory, in other types of plate loads, and other domains of physics is indicated. R.N.A.

N66-26169# Chalmers Univ. of Technology, Goteborg (Sweden).
STRESS REVERSALS IN CONNECTION WITH PRIMARY CREEP
Lars Sonnerup 1965 26 p refs *Its* Trans. No. 295 CFSTI: HC $2.00/MF $0.50

An investigation of a certain strain hardening creep law, applied to a case of stress reversal, is made. It is shown that this creep law has to be modified to be useful when stress reversals are at hand. Finally a simple problem with internal stresses combined with external load, giving a stress reversal during creep, is considered and the characteristic features of this type of problem are pointed out. Author

N66-26206# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF ELASTICITY AND PLASTICITY Collection of Articles
11 Jan. 1966 435 p refs Transl. into ENGLISH of the publ. "Issledovaniya po Uprugosti i Plastichnosti, Sbornik 2" Leningrad, Izd. Leningr. Univ., 1963 p 1-347
(FTD-MT-64-450; AD-630414) CFSTI: HC $7.05/MF $1.75

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6. DETERMINATION OF FREQUENCIES OF FREE VIBRATIONS OF CYLINDRICAL SHELLS E. I. Ivanyuta and R. M. Finkel'shteyn p 101-111 refs (See N66-26212 14-32)

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15. REMARKS CONCERNING THE THEORY OF PLANE PLASTIC STRESSED STATE A. I. Kuznetsov p 260-264 refs (See N66-26221 14-32)

16. MECHANICAL PROPERTIES OF ANISTROPIC LAMINAR PLASTICS DURING TESTS N. T. Smotrin and V. M. Chebanov p 265-280 refs (See N66-26222 14-18)

17. REMARKS ABOUT STRENGTH AND DESTRUCTION OF TEXTOLITE IN A COMPLEX STRESSED STATE IN THE CASE OF SIMPLE LOADING N. T. Smotrin and V. M. Chevanov p 281-289 refs (See N66-26223 14-18)

18. INVESTIGATION OF INFLUENCE OF PRELIMINARY PLASTIC STRAIN AND NATURAL AGING ON BEHAVIOR OF LOW-CARBON STEEL G. B. Talypov p 290-294 refs (See N66-26224 14-17)

19. CALCULATION OF TOROIDAL SHELLS K. F. Chernykh and V. A. Shamina p 295-397 refs (See N66-26225 14-32)

N66-26207# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RELATIONS BETWEEN STRESSES AND STRAINS IN ISOTROPIC AND INITIALLY ISOTROPIC INELASTIC MEDIA
A. A. Vakulenko *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 1-61 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

As part of an investigation of the theories of elasticity and plasticity, this paper examines the relations between stresses and strains in isotropic and initially isotropic inelastic media. Included are discussions of the structure of the function f and the law of reversible strain for initially isotropic or isotropic medium, the relation between stress and the characteristics of the irreversible strain component, solutions to equations for components of irreversible deformation rate, the inverse after effect in connection with plastic anisotropy, the role of nonlinear tensor terms, the construction of equations which take into account the character of irreversible deformation dependent on deformation conditions, and athermanous plastic deformation of an initially isotropic medium. R.N.A.

N66-26208# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF SHELLS UNDER CONCENTRATED INFLUENCES
V. V. Novoshilov and K. F. Chernykh *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 62-73 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

A dislocation method is proposed for the analysis of thin shells under concentrated influences. It appears that for shells of a general form, the principal parts of singularities of the solution corresponding to the concentrated influences, are the same as those for a plate. The obtained results are discussed. R.N.A.

N66-26209# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONCERNING QUESTION ABOUT DISTRIBUTION OF STRESSES IN ELASTIC HALF-PLANE WITH VARIABLE MODULUS OF ELASTICITY
S. G. Lekhnitskiy *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 74-81 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

Problems about distribution of stresses in elastic half space with a variable elastic modulus are of practical interest, but still have been little studied even for the two-dimensional case. This article shows that the problem about elastic equilibrium of half-plane under the action of concentrated force and distributed load has an elementary solution if the elastic modulus changes proportionally to some power of distance from the boundary. Author

N66-26210# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONCERNING THE QUESTION OF KINETICS OF GROWTH OF CRACKS
L. M. Kachanov *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 82-92 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

During a fixed load, equilibrium cracks remain constant. The growth of such cracks is possible, according to theory, only with a change of load. This paper considers the case of crack growth under variable loads. It is shown that crack growth is connected with the divergence of its edges caused by the nonelastic properties of the material. This divergence causes a decrease in cohesive forces. A phenomenological picture of the deformation is thus obtained which pertains to the medium on the whole and constitutes a certain averaging of processes which have a statistical character. However, complicated and delicate processes occur in the small region adjacent to the tip of the crack which do not always fit into the phenomenological picture. For instance, during the cleavage of a plate crack growth has been observed with the passage of time. Effects of this type can be described if it is assumed that the modulus of cohesion is not constant for a given material, but rather a certain function of time. R.N.A.

N66-26211# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

OSCILLATION OF TWO BODIES CONNECTED BY CIRCULAR CYLINDRICAL SHELL

G. N. Bukharinov *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 93–100 (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

There is studied motion of a system consisting of two rigid bodies with masses m and M connected by a circular cylindrical shell of mass m_0 under action of force F(t) applied to body of mass m and located on axis of symmetry (axis ox). Force F(t) is a certain given function of time t. Before application of force F(t), system was in equilibrium. Both bodies are rigidly attached shell. Author

N66-26212# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETERMINATION OF FREQUENCIES OF FREE VIBRATIONS OF CYLINDRICAL SHELLS

E. I. Ivanyuta and R. M. Finkel'shteyn *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 101–111 refs Presented at the Conf. on Theory of Plastic and Shells, Kazan', 1960 (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

Based on the known theory of V. Z. Vlasov, for frequency of free vibrations of a shell under arbitrary conditions of support of its ends, a comparatively simple formula is obtained by the variation method. For the particular case of a hinged shell, results of the work are compared with solutions of M. N. Lefonova, V. V. Novozhilov and V. Ye. Breslavskiy, which were obtained by methods differing from the method applied in this work. Other conditions of support of ends of shell besides hinged, as far as we were able to determine, have not been sufficiently discussed in the literature. In the work of A. P. Filippov a shell with rigidly clamped ends was considered. However, in view of complexity of results, they have not received practical application. Recently, American scientists published work, in which there are considered analogous problems; assumptions made by them make their solution useful only for long shells. Author

N66-26213# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF AXIALLY SYMMETRIC VIBRATIONS OF CYLINDRICAL SHELLS

E. I. Ivanyuta and R. M. Finkel'shteyn *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 112–128 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

The possibility of simplification of initial equations of axially symmetric vibrations of cylindrical shells for the purpose of obtaining engineering methods of analysis of the latter is investigated. An estimate is given of influence of initial stresses and embedding of the ends of the shell on frequency of free vibrations of the shell. Author

N66-26214# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

VIBRATIONS OF A PLANE SPIRAL SPRING

P. Ye. Tovstik *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 129–146 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

Small vibrations of a thin curvilinear rod, the elastic curve which is a plane curve, and one of the principle directions of cross section of which lies in the plane of the curve, are broken up into two forms: vibrations with displacements in the plane of the curve and with displacements perpendicular to plane of curve. Asymptotic expansions are considered for eigenfunctions and natural frequencies corresponding to both vibrational modes of a multiply turned plane-spiral spring with secured ends. Vibrations of a rod in the form of an Archimedes spiral are considered. Author

N66-26215# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE QUESTION OF BENDING OF A CYLINDRICAL SHELL BY A CONCENTRATED FORCE

Yu. S. Dem'yanovich *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 147–158 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

The problem of bending of a thin cylindrical shell of length l by a normal concentrated force is solved. For thin shells with accuracy sufficient for practical calculations it is possible to use roots of characteristic equation corresponding to Vlasov's equation of shallow shells. In the present work this equation, written in complex form, is used as the initial equation. Complex form of the equation to a considerable degree simplifies solution of the problem at hand. The obtained formulas differ from those already known in their simplicity, and as a result are fully suitable for practical calculations. Author

N66-26216# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE COMPENSATION METHOD OF DE SENARMONT

Ye. I. Edel'shteyn *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 183–200 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

This work describes a method for measuring phase difference, using the method of de Senarmont carried out in monochromatic light of two wavelengths, to determine the sign of the measured path difference and the whole number of wavelengths in it. R.N.A.

N66-26218# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF WELDING STRAINS AND STRESSES IN ARTICLES MADE FROM BIMETALS

V. S. Polozhentsev and G. B. Talypov *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 223–243 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

This paper presents the results of an investigation on the mechanical properties of the metal in each layer of a bimetallic sheet and describes a method for determining its initial stresses. An approximate theory of welding strains and stress is applied

to bimetals. An experimental check of theoretical results is made and the mechanical properties of the metal in the heated zone are investigated. D.M.A.

N66-26219# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FLOW OF A NONLINEAR VISCO-PLASTIC MEDIUM BETWEEN TWO PLATES

A. A. Tamonov *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 244–254 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

This article presents a generalization to the problem of flow between inclined plates for the case of a medium with a power dependence of plastic viscosity on strain rates, and also a generalization to the problem of a non-Newtonian liquid with an analogous dependence of effective viscosity on velocity gradient, i.e., when limiting shear stress is absent. R.N.A.

N66-26220# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE INFLUENCE OF TANGENTIAL FORCES OF INERTIA ON MAGNITUDE OF FREQUENCY OF FREE VIBRATIONS OF A THIN CYLINDRICAL SHELL

E. I. Ivanyuta and R. M. Finkel'shteyn *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 255–259 Presented at the Session of VNITO (All-Union Sci. Eng.-Tech. Soc.) of Shipbuilders, 25 Sep. 1959 (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

This note presents an estimation of the error due to a disregard of inertial forces caused by tangential displacements during the determination of free vibration frequencies of thin cylindrical shells with a circular cross section. R.N.A.

N66-26221# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

REMARKS CONCERNING THE THEORY OF PLANE PLASTIC STRESSED STATE

A. I. Kuznetsov *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 260–264 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

Some remarks concerning the theory of plasticity and elasticity are made for the case of a plane stressed state of an ideally plastic isotropic plate of constant thickness. It is noted that a previous conclusion concerning the rectilinearity of the rigid-plastic boundary of the plane stressed state and the orthogonality of characteristics on it, is the result of the condition of continuity of the normal component of rate on the boundary which was assumed to be analogous with the case of plane strain. It is shown that the characteristic coinciding with the line of discontinuity does not have to be rectilinear, and characteristics of the other family do not have to be orthogonal to it. R.N.A.

N66-26225# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CALCULATION OF TOROIDAL SHELLS

K. F. Chernykh and J. A. Shamina *In its* Invest. of Elasticity and Plasticity 11 Jan. 1966 p 295–397 refs (See N66-26206 14-32) CFSTI: HC $7.05/MF $1.75

General methods of calculating symmetrically loaded toroidal shells are presented, with equations derived for the symmetric deformation of shells of rotation, and circular toroidal shells. The periodic solution of the fundamental equation is examined, with consideration given to the method of continued fractions. Asympotic methods of integration are also discussed, with the method of standard equations proposed for the solution. Questions connected with strength and stability calculations, reverse-symmetric bend and shear, thermal stresses, large strains, carrying capacity, and analysis of pipes with curvilinear axis are assessed. Other methods dealing with the problem are critically surveyed, and a bibliography is included. M.G.J.

N66-26293# General Dynamics Corp., San Diego, Calif. General Atomic Div.

ON THE THEORY OF HYPERVELOCITY IMPACT Annual Status Report

J. K. Dienes, W. E. Johnson, and J. M. Walsh 28 Jun. 1965 124 p refs

(Contract DA-04-495-AMC-116(X); ARPA Order 71-62) (GA-6509; AD-617540) CFSTI: HC $4.00/MF $1.00

The three principal areas of activity, (1) Numerical solutions of problems in impact, (2) Code development for solving impact problems, and (3) Analytical work on the theory of the impact process, are reviewed, utilizing wherever possible cited papers which have been published during this past year as part of the project work. The investigations covered in these papers are described only briefly in the present status report, familiarity with or availability of the original documents being assumed. The major part of the present discussion is devoted to a status report of unfinished work on the problem of computing strength-dependent and viscous impact flows. A computer program is described for generalizing Eulerian hydrodynamic codes to include these effects and sample calculations are given. Author (TAB)

N66-26321# Massachusetts Inst. of Tech., Cambridge.

RANDOM VIBRATION OF COUPLED OSCILLATORS AND COUPLED STRUCTURES

Terry Don Scharton (Ph.D. Thesis) Oct. 1965 143 p refs (Contract AF 49(638)-1314)

(AFOSR-66-0156; AD-630794) CFSTI: HC $14.60/MF $1.00

It is proved that the time average power flow between two linearly coupled linear oscillators excited by independent white noise sources is proportional to the difference in the time average energies of the oscillators. This proportionality is valid even when the oscillators are strongly coupled if the oscillator energies are defined correctly. The validity of power-flow energy-difference proportionality in systems of more than two oscillators is hypothesized. Some conceptual difficulties involved in formulating a coupled structures are discussed. An experimental investigation of a beam-beam structure demonstrates that the coupled oscillator power flow calculation can be used to predict power flow and energy sharing in coupled continuous structures excited with broadband noise. Author (TAB)

N66-26339# California Univ., Berkeley. Operations Research Center.

AN EXTENSION OF GENERALIZED UPPER BOUNDED TECHNIQUES I FOR STRUCTURED LINEAR PROGRAMS

M. Sakarovitch and R. Saigal Dec. 1965 17 p refs

(Contract DA-31-124-ARO-D-331; Grants NIH GM-9606; NSF GP-4593)

(ORC-65-33; AROD-5307-7; AD-630881) CFSTI: HC $1.60/MF $0.50

An algorithm is developed for solving a special structured linear program. The particular structure studied has a large number of blocks coupled together by a relatively few connecting equations. The method proposed is an extension of "Generalized Upper Bounding Techniques for Linear Programming-I" by G. B. Dantzig and R. M. Van Slyke (March 1965) and, from the basis, defines a working basis which is much smaller in size than the original. Two methods of updating the working basis are proposed. Author (TAB)

N66-26366# Northwestern Technological Inst., Evanston, Ill. Structural Mechanics Lab.

DYNAMIC RESPONSE OF ORTHOTROPIC CYLINDRICAL SANDWICH SHELLS UNDER INITIAL STRESS

Edward H. Baker and George Herrmann Feb. 1966 50 p refs /*Its* Tech. Rept.-66-1

(Grant AF-AFOSR-100-65)

(AFOSR-66-0133; AD-630426) CFSTI: HC $2.00/MF $0.50

A linearized theory of motion of cylindrical sandwich shells, subjected to a general state of initial stress, is established. The effects of orthotropic core and orthotropic facing sheets of unequal thickness are included. As an application, an analysis of free vibration is presented. Author (TAB)

N66-26444# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.

COUPLED VIBRATORY SYSTEM ANALYSIS USING THE DUAL FORMULATION

Dean Karnopp Nov. 1965 16 p refs

(Contract AF 49(638)-1314)

(AFOSR-65-2675; AD-628216) CFSTI: HC $1.60/MF $0.50

Principles by means of which an arbitrary vibrational system may be cut into subsystems and described by coupled model equations are exposed and illustrated with an elementary example. The symmetry of the equations attainable when both the usual geometric description and the dual or force space representation are used is shown. The difficulties in use and interpretation of the coupled equations when the coupling is not weak are discussed. Author (TAB)

N66-26445# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.

ELASTIC MODULI OF COMPOSITE MATERIALS REINFORCED WITH ORTHOTROPIC FILAMENTS Technical Summary Report, Aug.-Nov. 1965

James M. Whitney Jan. 1966 22 p refs

(AFML-TR-65-411; AD-630251) CFSTI: HC $1.00/MF $0.50

Approximate equations for determining the elastic constants of a unidirectional composite material reinforced with an orthotropic filament are derived. In particular, equations are developed for longitudinal modulus, transverse modulus, Poisson's ratio, and shear modulus. Filament and matrix elastic constants and fiber volume percent are the necessary parameters for determining these constants. Classical theory of elasticity is applied to a composite unit cell resulting in closed form solutions. Air stress functions are applied to the fiber and matrix with boundary conditions requiring continuity of displacements across the fiber–matrix interface (perfect bonding is assumed) and continuity of appropriate stresses. Graphical results are shown for transverse modulus and shear modulus. Author (TAB)

N66-26452# Bettis Atomic Power Lab., Pittsburgh, Pa.

THE INFLUENCE OF THE SYSTEM GEOMETRY ON FRACTURE TOUGHNESS

Richard Elwyn Johnson (Ph.D. Thesis—Carnegie Inst. of Tech.) 1965 280 p refs

(Contract AT(11-1)-GEN-14)

(WAPD-T-1828) CFSTI: HC $6.00/MF $1.50

Enough reports of variation in plane strain fracture toughness with notch system geometry exist to cast doubt on the applicability of this parameter to component design and on the predictability of fracture mechanics in general. Based on the observation that the greatest variations in fracture toughness were observed in the presence of large bending forces, a load-dependence hypothesis was advanced by Romualdi. To test the hypothesis, an experiment was designed to provide critical data with which to assess the geometry dependence of plane strain fracture toughness. Fracture tests were run using plaster and graphite which, in conjunction with results on metals obtained by others, provided a broad spectrum of inherent material ductility. No significant variation in plane strain fracture toughness dependent on notch system geometry was observed. A corollary to the assertion that plane strain fracture toughness is system geometry independent was noted, namely: a ratio of brittle fracture strengths reflecting a change in system geometry will be material independent for sets of geometrically identical specimens. The fracture data were shown to behave in accordance with the corollary. It was concluded that the methods of fracture mechanics can be employed to obtain laboratory determinations of plane strain fracture toughness that will be applicable to components without regard for differences in system geometries. Author (NSA)

N66-26477# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

FRACTURE MECHANICS AND THE STABILITY OF ENGINEERING STRUCTURES

M. B. Reynolds Sep. 1965 55 p refs

(Contract AT(04-3)-189)

(GEAP-4678) CFSTI: HC $3.00/MF $0.50

A review is presented on the stability of engineering structures. Catastrophic failures in structures are of two types: those resulting from the very rapid propagation of a brittle crack; and those of the ductile tearing type. The conditions for unstable deformation are developed by examining the deformation behavior of a solid cylinder under uniaxial tension. The effect of both the stress-strain characteristics of the material and the stiffness of the applied load are considered. It is shown that for stability the condition $(dP/d\lambda) \geq -k$ must be satisfied, where k is the stiffness of the applied load and $dP/d\lambda$ is the slope of the load-deformation curve for the structure. The Tresca and von Mises criteria for plastic yielding under multiaxial stresses are given, followed by review of several papers on the homogeneous plastic deformation of hollow spheres and cylinders under internal pressure. The Griffith and Irwin criteria for stability of a brittle crack are described, followed by development of the fracture toughness concept and discussion of the corrections necessary to apply the Griffith-Irwin fracture mechanics to relatively ductile materials. The brittle–ductile fracture transition is described in terms of the effect of temperature on the yield and fracture stresses of the material. Finally, the commonly used criteria for fracture-safe design in ferritic alloys are discussed. Two appendices are devoted to techniques for fracture toughness testing and to a brief summary of fatigue crack growth laws.

Author (NSA)

N66-26510# J. G. Engineering Research Associates, Baltimore, Md.

COLLAPSE, BUCKLING AND POST FAILURE BEHAVIOR OF CYLINDRICAL SHELLS UNDER ELEVATED TEMPERATURE AND DYNAMIC LOADS

Joshua E. Greenspon Nov. 1965 44 p refs
(Contract DA-18-001-AMC-707(X))
(TR-6; AD-620269) CFSTI: HC $2.00/MF $0.50

The analytical details of representing the deformation patterns and the method for calculating the energy absorbed and the resulting deflection under normal and elevated temperature conditions due to a given loading are described. In addition to energy and impulse methods of solving the problem a deformation type variational principle is employed to set up the governing nonlinear differential equation for the time dependent deflection in the plastic region. The biaxial stress strain law used for both the normal and elevated temperature cases is an elastic linear hardening law. Of greatest importance in the report is the computation of the energy absorbed or work done by internal forces in the shell for very large plastic deformations. This work or energy can be used to compute the impulse to give a prescribed deformation; it can be used to compute the deformation for a given energy input to the shell (assuming all of it goes into plastic deformation); it can be used to compute static load for a given deformation; or it can be used as a design criterion itself. Author (TAB)

N66-26522# Naval Civil Engineering Lab., Port Hueneme, Calif.
DYNAMICALLY LOADED STRIP FOOTING BURIED IN DRY SAND
Charles R. White Aug. 1965 29 p refs
(Contract DASA-13.018)
(R-387; AD-619815) CFSTI: HC $2.00/MF $0.50

The report describes the dynamic loading of a 12-inch-wide by 18-inch-deep by 6-foot-long concrete footing, representing the strip footing of a subsurface shelter. Boundary conditions simulated those of a torsionally restrained footing of a flexible arch structure test-loaded at several different depths of burial. Static overburden pressure was applied only on one side to simulate the footing of an exterior wall. Dynamic loads from 5 to 40 kips per square foot were applied to the footing while the adjacent soil was under simulated overburden pressures of zero to 15 psi. A logarithmic relationship between bearing modulus and overburden is demonstrated for downward displacements of the footing ranging from 0.25 to 1.5 inches. The dynamic secant modulus increased exponentially with static overburden pressure. Author (TAB)

N66-26530# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Mechanical Engineering.
ON THE AXISYMMETRICAL VIBRATIONS OF CONICAL SHELLS Scientific Report No. 6
Yukio Kagawa Jun. 1965 19 p refs
(Contract AF 49(638)-1290)
(AFOSR-65-1422; AD-627963) CFSTI: HC $1.00/MF $0.50

In this paper it is shown that the fundamental frequencies of the axisymmetrical vibrations of conical shells can be predicted quite accurately by the extensional theory as long as the thickness of the shell is small compared with [illegible] and the apex angle is not too wide. This is confirmed [illegible] the results of the extensional theory with those of [illegible] and with those of the more exact theory including [illegible] effect. (TAB)

N66-26609# Boeing Co., Morton, Pa. Vertol Div.
AN EXPERIMENTAL EVALUATION OF THE CONFORMAL GEAR Final Report
J. C. Mack, J. P. Alberti, and A. J. Lemanski Ft. Eustis, Va., Army Aviation Mater. Labs., Feb. 1966 80 p refs
(Contract DA-44-177-AMC-101(T))
(R-429A; USAAVLABS-TR-66-8; AD-630925) CFSTI: HC $3.00/MF $0.75

The conformal gear was studied as a means of improving helicopter final reduction drives. By eliminating certain inherent limitations of the involute gear, the developed conformal tooth form has the potential of bettering current power-to-weight ratios. An analytical and experimental effort was conducted on carburized and ground conformal gears. TAB

N66-26689# Brown Univ., Providence, R. I. Div. of Engineering.
ON STABILITY OF VISCOPLASTIC SYSTEMS WITH THERMO-MECHANICAL COUPLING
D. Rubin and D. C. Drucker Nov. 1965 19 p refs
(Contract Nonr-562(20))
(TR-47; AD-630922)

The stability of equilibrium configurations of thermo-mechanically coupled systems in the plastic and the visco-plastic range is examined through simple examples and by dimensional analysis. A uniform fully-insulated thin-walled tube twisted into the inelastic range is studied first. The material is idealized as linear work-hardening viscoplastic with a current yield stress which decreases linearly with increase in temperature. Any annealing or age-hardening or similar influence of time at temperature is supposed negligible. A local stability criterion beta>1 governs, where beta is the ratio of the heat stored in the material to the heat generated by inelastic deformation with a given temperature rise. Neither viscosity nor heat conduction enters into the stability or instability of this homogeneous system. They both play a role in successive modifications of the simple model which demonstrate the stabilizing effect of heat transfer to the surroundings and of the heat capacity in regions of material below yield. Author (TAB)

N66-26690*# Minnesota Univ., Minneapolis.
THEORY OF TIME DEPENDENT MECHANICAL BREAKDOWN OF ORIENTED MEDIA Technical Report No. 104
C. C. Hsiano, S. R. Moghe, and H. H. Kausch von Schmeling Mar. 1966 16 p refs
(Grant NGR-24-005-070)
(NASA-CR-95084) CFSTI: HC $1.00/MF $0.50 CSCL 20K

A phenomenological theory of the time dependent nature of mechanical breakdown phenomena is presented for homogeneous oriented and stressed solids. On the basis of considering the kinetic breaking and forming processes in the microscopic molecular structure, a general theory is formulated and analyzed. The solution to this formulation gives not only reasonable results comparable to available experimental findings but also yields new information which may or may not be able to be verified experimentally. In general it is found that for a wide range of large applied tensile stresses, the fracture strength is almost linearly related with logarithm of time. For small stresses, however, the time-to-break required approaches to infinity. Author

N66-26702*# Midwest Applied Science Corp., Lafayette, Inc.
THE DEVELOPMENT OF COMPUTATIONAL TECHNIQUES FOR THE IDENTIFICATION OF LINEAR AND NONLINEAR MECHANICAL SYSTEMS SUBJECT TO RANDOM EXCITATION First Quarterly Report
Will Gersch Mar. 1966 41 p refs
(Contract NAS5-10106)
(NASA-CR-75068) CFSTI: HC $2.00/MF $0.50 CSCL 20K

A computational procedure was suggested to determine the differential equation governing the motion of linear and nonlinear structural systems subject to random excitation when the system excitation and response are observed. Such a procedure can yield the transfer functions, impedances, and damping coefficients of linear systems, as well as determine the nonlinearities in the spring and damping coefficients governing the motion of nonlinear structures. Descriptions are given of the procedural approach taken in identifying structural systems, and of the quasilinearization least-squares stagewise smoothing parameter estimation procedure that occupies a central role in the computational procedure. Preliminary computational results illustrating the identification of a simulated one degree of freedom system achieved by the methods suggested are also presented. Author

N66-26704*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.

ANALYSIS OF WEBS OF PARTIAL-TENSION-FIELD BEAMS SUBJECTED TO LATERAL PRESSURE LOADINGS

L. Kovalevsky, T. Furuike, L. A. Nelson, and F. L. Rish Apr. 1966 303 p refs

(Contract NAS8-20113)

(NASA-CR-75054; SID-66-135) CFSTI: HC $7.00/MF $1.75 CSCL 20K

State-of-the-art theories on partial-tension field beams subjected to vertical loadings are summarized as a preliminary step in developing a procedure for analyzing straight and curved partial-tension field beams subjected to combined vertical and lateral pressure loadings. Procedures are described for determining the stresses and deformation in beams subjected to lateral pressure, and the response of uprights and flanges to such loading is discussed. Beam behavior when vertical and lateral loadings are applied simultaneously is analyzed, and formulas and graphs used in determining stresses and stability of the uprights and flanges are presented. A general analytical procedure is also developed for curved beams which closely follows the method used in the straight beam analysis. It is pointed out that the methods are applicable to various boundary conditions, and are valid for simple, cantilever, and continuous beams, and other beam systems as long as the structure is properly idealized for the partial-tension field beam analysis. Illustrative examples, some derivations, and the IBM 7094 computer programs for simplifying the numerical solutions are also included. M.G.J.

N66-26713# Brown Univ., Providence, R. I. Div. of Engineering.

ON THE MEANING OF CONCENTRATED LOAD SOLUTIONS IN THE PLASTIC THEORY OF STRUCTURES

Charles A. Anderson and Richard T. Shield Mar. 1965 86 refs

(Contract Nonr-562(20))

(TR-42; AD-616563) CFSTI: HC $3.00/MF $0.75

The report investigates the significance of structural theory solutions for structures composed of perfectly-plastic materials when the loading is of a highly localized nature. Limit analysis is applied to illustrative problems involving structures elements of typical dimensions in order to compare the actual collapse loads with those provided by the structural theory. For strip loading of a rectangular beam or circular cylindrical shell it is found that as the width of the loaded region decreases the transition from the type of failure predicted by this structural theory to failure due to local plastic flow is very abrupt, and the structural theory is accurate even for strip widths which are small compared to the thickness of the beam or shell. For a circular plate under a central disc of pressure the results obtained indicate that the transition from the collapse mechanism predicted by the plate theory to local plastic flow involves intermediate mechanisms with appreciable transverse shear resultants, and for plate theory to apply the diameter of the disc must be greater than the plate thickness. Author (TAB)

N66-26732# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.

THE BREATHING-VIBRATIONS OF A THIN CYLINDER PARTIALLY FILLED WITH A FLUID [VIBRATIONS DE RESPIRATION D'UN CYLINDRE MINCE PARTIELLEMENT REMPLI DE LIQUIDE]

Jean Leroy 1965 55 p refs In FRENCH; ENGLISH summary (Publ.-113) CFSTI: HC $3.00/MF $0.50

The natural modes found for an empty cylinder define a complete base of the deformations for the type of boundary-conditions considered. These conditions remain verified when the cylinder is partially or totally filled. Thus the equations of mechanics on the basis of these functions can be written. A generalized theory of the phenomena is developed within Love's approximations. Because of the complexity of the results obtained, two simplifying assumptions are introduced; they tend to make the natural functions of the liquid similar to that of the cylinder. The effect of a constant internal pressure is studied; test results are presented and compared to those given by the generalized theory and by the simplified determination. Author

N66-26734# Royal Inst. of Tech., Stockholm (Sweden).

FOUNDATIONS OF THE MATHEMATICAL THEORY OF BRITTLE FRACTURE. SOME RECENT PROBLEMS OF KINETICS OF CRACKS. THEORY OF BRITTLE STRENGTH. SOME RECENT ADVANCES IN THE THEORY OF CRACKS IN NON-HOMOGENEOUS BODIES

G. I. Barenblatt 1965 35 p refs Guest lectures presented at Roy. Inst. of Tech., Nov. 1964

(Publ.-149) CFSTI: HC $2.00/MF $0.50

The theory of brittle fracture is discussed with emphasis on the formulation of the fracture problem as a mathematical problem. Static cracks, conditions for equilibrium cracks, size of crack, and cohesion modulus are mentioned. Experiments are described to confirm theory. The complexity of kinetic cracks is illustrated by two examples: and infinite plate which is stressed at infinity by uniformly distributed stresses; and a slowly moving wedge producing a free crack, assumed to move slowly. A theory of brittle strength is developed which includes the equilibrium of an elastic body with cracks, the strength of the body, cracks in nonhomogeneous bodies, and glued plates separated by normal forces. N.E.N.

N66-26738# National Aerospace Lab., Tokyo (Japan).

THE SHAPE OF MECHANICAL HYSTERESIS LOOP, ITS DEFORMATION DUE TO STRESS REPETITION AND RESULTING INCREASE IN FLOW STRESS

Fujio Nakanishi, Yasuo Sato, and Fumio Nagai 1965 33 p refs In JAPANESE; ENGLISH summary

(NAL-TR-90) CFSTI: HC $2.00/MF $0.50

Experimental results of the hysteresis loops during repeated torsion, pure shear and tension are presented in this paper. The following observations are made: (1) The stress-strain relations in reloading and unloading are symmetric. (2) The hysteresis loop is composed of several sections. For instance, the reloading or unloading curve in torsion has three straight sections and shows bends at stresses of one third and two thirds of the flow stress. (3) The beginning section of reloading curve is elastic while the slopes of the other lines

vary as the stress is repeated thus resulting in a change in the shape of the loop. (4) The stress repetition produces an increase in the stress for the commencement of plastic flow, but this effect vanishes as the plastic flow is continued. Author

N66-26838# California Univ., Berkeley. Div. of Applied Mechanics.

DYNAMIC STABILITY OF AUTONOMOUS AND CONTINUOUS ELASTIC SYSTEMS

C. S. Hsu Jan. 1966 46 p refs

(Contract Nonr-222(69))

(AM-66-3; AD-630773) CFSTI: HC $4.60/MF $0.50

The dynamical behavior of autonomous and continuous elastic systems is studied qualitatively in terms of trajectories in appropriately defined functional phase spaces. It is found that the local stability equilibrium configurations in a dynamical sense and the stability in the large may be investigated in a more satisfactory manner by adopting this approach. By studying the distribution of the equilibrium configurations in the functional phase space and by extending Liapunov's theorems on stability to continuous systems, sufficiency regions of stability can be established for the following types of problems: elastic systems subjected to (at t=0) impulsive body loads, sudden changes of body loads, sudden changes of boundary conditions of 'traction' type, and sudden changes of body loads of finite duration. Author (TAB)

N66-26875*# Aerojet-General Nucleonics, San Ramon, Calif. Research Div.

METEOROID IMPACT SIMULATION BY MAGNETIC GRADIENT PARTICLE ACCELERATION TECHNIQUES Final Technical Report, 1 Jul. 1964–15 Apr. 1966

Robert L. Chapman May 1966 56 p refs

(Contract NAS8-11174)

(NASA-CR-75284; AN-1490) CFSTI: HC $3.00/MF $0.50 CSCL 20K

The feasibility of using strong magnetic field gradients to accelerate small metallic projectiles to velocities suitable for simulating micrometeoroid impacts was investigated. Both linear and nonlinear analyses of the magnetic field diffusion into the projectile indicated only surface vaporization of the projectile. Modifications in the test device include a multiple detonator initiation system, a special firing system, and a capacitor discharge replacing a battery discharge in the magnetic system. High speed photographic techniques used in the experiments are mentioned. Among the projectile flight chamber observations are that metallic material from the projectile surface was accelerated, luminous material comes off the inner flux concentrator surface, and the projectile's velocity appears to be in the low tens of km/sec range. No discrete projectile was observed to come out of the accelerator. It was concluded that the use of the magnetic gradient accelerator is feasible, but that more work is needed to determine if the projectile is trapped inside the accelerator. N.E.N.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N66-25392# Institut Franco-Allemand de Recherches, St. Louis (France).

COMBUSTION PHENOMENA PRODUCED BY THE HIGH-VELOCITY SHOOTING OF CONICAL PROJECTILES IN DETONATING GAS [VERBRENNUNGSVORGANGE BEI HOCHGESCHWINDIG-KEITSCHUSSEN MIT KEGELGESCHOSSEN IN KNALLGAS]

H. Behrens and W. Struth 21 Dec. 1964 56 p refs In GERMAN

(Contract T-453-I-206)

(ISL-T-41/64) CFSTI: HC $3.00/MF $0.50

Experiments with plastic projectiles of 9 mm diameter with conical point, fired at velocities from 1700 to 2700 m/s in hydrogen–air or hydrogen–oxygen mixtures, are reported. Characteristics were examined by means of short-time photographs by the silhouette method. Ignition and combustion phenomena with various velocities and gas mixtures are discussed. Quantitative evaluation of results by the theory of the oblique detonation wave is given. The relative amount of heat resulting from chemical reaction is calculated.

Transl. by K.W.

N66-25436# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

THERMAL PROPERITES OF POLYPHENYLS–DETERMINATION OF INCEPTION OF NUCLEATE BOILING IN THE THERPHENYL OM2 IN CONDITIONS OF FORCED CONVECTION [PROPRIETES THERMIQUE DES POLYPHENYLES—DETERMINATION DU DEBUT DE L'EBULLITION NUCLEEE DU TERPHENYLE OM2 EN CONVECTION FORCEE]

A. Fiore and R. Ricque Brussels, EURATOM, Oct. 1965 32 p refs In FRENCH; ENGLISH summary

(Contract EURATOM-162-64-1 ORGF)

(EUR-2442.f) CFSTI: HC $2.00/MF $0.50

A description is given of a theoretical method for determining the inception of nucleate boiling in forced convection. This method is applied to the terphenyl used in the loop LO 50 P, in the operating conditions of this loop. A comparison is then drawn between the theoretical and the experimental results. Author

N66-25441# Academy of Sciences (USSR), Moscow.

OPTIMUM CONTOUR OF HEAT REJECTING TRANGULAR FINS WITH MUTUAL IRRADIATION BETWEEN FINS AND COOLED BASE SURFACES. THE SYSTEM OF PARALLEL STAR-SHAPED RADIATORS. EFFECTS OF THE THERMAL RESISTANCE OF COATINGS

Y. A. Vasanov and Y. G. Julev [1964] 32 p refs

CFSTI: HC $2.00/MF $0.50

This paper discusses the results of an investigation of star shaped radiators. A numerical solution is given of a one-dimensional problem of the optimum size and number of heat rejection triangular fins radially arranged at the spices of the polyhedral prism with mutual irradiation of the fins and the surface of the cooled prism. Dimensionless parameter relations are given which determine the optimum number of fins and their geometry for any combination of the cooled prism temperature and size, amount of the rejected heat, emissivity of radiating fins, and heat conductivity of the fin material. The optimum number of radiating fins increases from 4 for black emitting surfaces to about 10–11 for the emissivity of these surfaces of the order of 0.5. The thermal radiation characteristics of an infinite system of four-fin star-shaped coplaner radiators are calculated taking into account the mutual irradiation of all radiator elements. The optimal characteristics of the system are calculated for any distance between the

adjacent radiators of the system. The effect of coating thermal resistance on the heat radiation characteristics of star shaped radiators is discussed. R.N.A.

N66-25445# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany). Istitut für Luftstrahlantriebe.
MEASUREMENTS OF RELAXATION EFFECTS IN NOZZLE FLOW OF HOT COMBUSTION GASES BY MEANS OF A SHOCK TUBE TECHNIQUE [MESSUNGEN VON RELAXATIONSEFFEKTEN IN DUSENTROMUNGEN HEISSER VERBRENNUNGSGASE MITTELS EINER STOSSROHRANORDNUNG]
Th. Just and H. Pippert Jan. 1966 43 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-01; DVL-496) CFSTI: HC $2.00/MF $0.50

We investigated chemical relaxation effects in nozzle flow by measuring the temperatures along the nozzle. The high temperatures required were easily produced by detonation waves. Temperatures were measured with the aid of the atomic-line-reversal method. This method had to be modified on account of the short time intervals of constant flow in our shock tube. Hydrocarbons were burnt with air, respectively oxygen. First results for varied angles of the nozzles are reported. Author

N66-25518# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
VAN DER WAALS WIGGLES, MAXWELL RULE AND TEMPERATURE DEPENDENT EXCITATIONS
Gerard G. Emch Mar. 1966 26 p refs
(Contract Nonr-595(22))
(BN-437; AD-629888) CFSTI: HC $2.00/MF $0.50

Starting from a temperature-independant Hamiltonian, one discusses for some models the coexistence of the van der Waals wiggles and the Maxwell–van der Waals isotherms. The main tool of this paper is provided by the temperature-dependent excitations techniques developed in an earlier paper. Some ferromagnetic models and lattice-gas models are treated along similar lines. The van der Waals wiggles and the Maxwell–van der Waals isotherms appear below the critical temperature as two solutions of a system of self-consistent equations. The choice between the two solutions is then dictated by energy considerations. Author (TAB)

N66-25552*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SETS OF SIMILARITY RATIOS FOR THERMAL MODELING
J. R. Watkins Washington, NASA, May 1966 46 p refs
(NASA-TN-D-3452) CFSTI: HC $2.00/MF $0.50 CSCL 20M

An effort was made to show that more than one set of independent similarity ratios for thermal modeling exist. All possible sets of these independent ratios are presented in tabular form for thermal modeling in a simulated space environment. The ratios were derived by a computer program performing a dimensional analysis on the physical quantities defining the thermal behavior of the prototype in a space environment. D.T.

N66-25805# Aktiebolaget Atomenergi, Stockholm (Sweden).
EFFECT OF BUOYANCY ON FORCED CONVECTION HEAT TRANSFER IN VERTICAL CHANNELS—A LITERATURE SURVEY
Ajay Bhattacharyya Mar. 1965 31 p refs
(AE-176) CFSTI: HC $2.00/MF $0.50

This report contains a short resume of the available information from various sources on the effect of free convection flow on forced convection heat transfer in vertical channels. Both theoretical and experimental investigations are included. Nearly all of the theoretical investigations are concerned with laminar flow with or without internal heat generation. More consistent data are available for upward flow than for downward flow. Curves are presented to determine whether free convection or forced convection mode of heat transfer is predominant for a particular Reynolds number and Rayleigh number. A $Re_b > 10^5$ free convection effects are negligible. Downward flow through a heated channel at low Reynolds number is unstable. Under similar conditions the overall heat transfer coefficient for downward flow tends to be higher than that for upward flow. Author

N66-25889# Minnesota Univ., Minneapolis. Heat Transfer Lab.
HOT-WIRE ANEMOMETER STUDY OF A TURBULENT BOUNDARY LAYER ON A POROUS AXIAL CIRCULAR CYLINDER WITH UNIFORM AIR INJECTION
V. K. Jonsson and W. D. Batton Sep. 1965 104 p
(Grant AF-AFOSR-17-65)
(HTL-TR-65; AD-628083) CFSTI: HC $4.00/MF $0.75

The report deals with a hot-wire anemometer study of a turbulent boundary layer on a porous axial cylinder with a free stream velocity of 120 feet per second. The variations through the boundary layer of the transverse and longitudinal fluctuating velocity components, the Reynolds stress, the turbulent friction coefficient, and the correlation coefficient were obtained at axial Reynolds numbers of 400,000, 600,000 and 900,000. Two cases of injection with air were studied in addition to the case of no injection. The value of the dimensionless injection rate was 0, 0.000084, and 0.00020. Author (TAB)

N66-25932# National Bureau of Standards, Washington, D. C.
TABLE OF THERMODYNAMIC PROPERTIES AND CHEMICAL COMPOSITION OF NITROGEN IN CHEMICAL EQUILIBRIUM INCLUDING SECOND VIRIAL CORRECTIONS FROM 1600°K TO 15,000°K
Joseph Hilsenrath and Max Klein Arnold AF Station, Tenn., Arnold Eng. Develop. Center, Apr. 1966 309 p refs Supersedes AEDC-TDR-63-162
(AEDC-TR-66-65; AEDC-TDR-63-162; AD-630461) CFSTI: HC $7.00/MF $1.50

Tables for the thermodynamic properties for nitrogen are presented which take into account the effect of dissociation and ionization and the limiting-law Debye–Hückel and second virial corrections, upon the thermodynamic properties and the equilibrium compositions. Values are tabulated from 1600°K in steps of 100°K to 15,000°K at close spacings in the logarithm of the density [$\log_{10}$ =7.0 (0.2) 2.2] for the compressibility factor Z=PV/RT; the dimensionless functions for: internal energy, E/RT; enthalpy, H/RT; entropy, S/R; $\log_{10}$P(atm) and $Z^* = \Sigma C_i$ and the mole fractions of the species in chemical equilibrium. The underlying equations and the input data are discussed briefly. The effects of the real gas corrections on the equilibrium properties are illustrated graphically. The equilibrium composition is given for selected temperatures over the tabulated density range. The wide range of temperatures and densities over which the thermodynamic properties have been tabulated make the tables useful in a variety of engineering design and test programs, and in scientific research and development. Author (TAB)

N66-25935# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF MEASURING THE TEMPERATURE FIELD OF A STREAM OF EXHAUST GASES

I. L. Frolovskiy 18 Feb. 1966 4 p Transl. into ENGLISH from Russian Patent no. 144559 (Appl. no. 890881/26-10, 25 Mar. 1964)
(FTD-TT-65-1944/1+4; AD-630272) CFSTI: HC $1.10/MF $0.50

Object of the Invention: A method of measuring the temperature field of a stream of exhaust gases, for example, on the test stand of gas turbine engines, with the help of a thermocouple which has the distinguishing feature that for the purpose of improving the precision of the measurements and shortening the time spent on the test the thermocouple is set up between the engine and the exhaust system, the measuring of the temperature field is done in this section, and the results obtained are converted mathematically with the taking into account of the vortex in the gas stream. Author (TAB)

N66-25983# Martin Co., Baltimore, Md. Nuclear Div.
PARAMETRIC RE-ENTRY ABLATION STUDY OF HYPOTHETICAL STRONTIUM-90 FUEL FORMS Final Report
William E. Osmeyer and Edward L. Carter Jan. 1966 182 p refs
(Contract AT(30-1)-3082)
(MND-3062-25) CFSTI: HC $5.00/MF $1.00

Analytical computer programs were used to describe the reentry trajectory, heat flux, ablation and molten droplet behavior of hypothetical strontium-90 fuel capsules exposed to a reentry environment during the descent from orbit of a radioisotopic generator. A detailed parametric study was performed which covered a wide range of capsule designs and fuel form properties. Although gross capsule trajectory and ablation computer programs were available, new programs were generated to consider deceleration, breakup and ablation of micron size droplets. The capsule design and material property influence upon ablation was investigated for three major phases of the capsule reentry ablation history: encapsulation material ablation; fuel form ablation; and molten droplet breakup and ablation. The most influential ablation parameters for each phase were determined. Author (NSA)

N66-26047# Institut Franco-Allemand de Recherches, St. Louis (France).
DETERMINATION OF THE THERMAL CONDUCTIVITY OF HOT GASES WITH THE AID OF THE THERMAL BOUNDARY LAYER IN THE SHOCK TUBE [BESTIMMUNG DER WARMELEITFAHIGKEIT HEISSER GASE AUS DER TEMPERATURGRENZSCHICHT IM STOSSROHR]
G. Smeets 2 Sep. 1964 61 p refs In GERMAN
(ISL-3/64) CFSTI: HC $3.00/MF $0.75

The pure thermal boundary layer that forms after the reflection of the shock at the closed end of the shock tube is treated. The interference image appearing during observation of the thermal boundary layer in the differential interferometer is calculated. Since the thermal boundary layer and its interference image depend on the thermal conductivity of the gas in the shock tube, conductivity can be derived from the interferogram. A method for this purpose was developed and is explained. As an example, the conductivity of air within the temperature interval $1140°K \leq T \leq 6075°K$ at density $\rho = 0.1\rho_N$ is determined. Transl. by K.W.

N66-26113# Joint Publications Research Service, Washington, D. C.
AN EXPERIMENTAL INVESTIGATION OF THE ERROR OF MEASUREMENT OF SURFACE TEMPERATURES
Vung-lieh Ch'in *In its* Izv. VUZov: Instr. Bldg., No. 6, 12 May 1966 p 165–168 ref (See N66-26086 14-14) CFSTI: $6.00

An analysis of the errors made in the measurement of surface temperatures was conducted. An equation for the relative surface temperature measurement error is given and the experiments conducted to quantitatively verify this equation are described. Data derived from surface temperature measurements using thermocouples and resistance-type temperature detectors are compared in graphs, and the effect of the orientation of the surface of the specimen to be tested is discussed. H.S.W.

N66-26114# Joint Publications Research Service, Washington, D. C.
ON THE CALCULATION OF THE THERMAL CONDUCTIONS IN RADIOELECTRONIC APPARATUSES
A. I. Kaydanov *In its* Izv. VUZov: Instr. Bldg., No. 6 12 May 1966 p 169–173 refs (See N66-26086 14-14) CFSTI: $6.00

The process of thermal conduction between separate surfaces of radioelectronic apparatus was examined. A description of the heat exchange processes involved is given and the parameters considered are defined. Formulas are derived for the temperature function of: the radiant component of the thermal conduction; the convective component of the thermal conduction between the external surfaces and the surrounding medium; the convective component of the thermal conduction between the separate surfaces within a section; the conductive component of the thermal conduction in a gaseous interlayer; and the conductive component of the thermal conduction in solids. H.S.W.

N66-26127# Joint Publications Research Service, Washington, D. C.
ON THE MAXIMUM TIME INTERVAL IN THE NUMERICAL CALCULATION OF KINETIC HEATING
V. S. Zarubin *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 1–6 refs (See N66-26126 14-01) CFSTI: $3.00

Approximate numerical methods are presented for calculating the maximum time interval of kinetic heating in aircraft structures during flight. Two examples are given. In the first case, an unreinforced thin metal skin is considered, in which the thermal resistance is usually small in comparison to the thermal resistance of heat transfer from the air stream. Therefore, the temperature of the skin corresponding to a moment of time is assumed to be constant throughout its thickness. An equation is derived for the heat flow balance for the interval of time, to determine the amount of heat which enters due to convective heat transfer. Figures are also included to depict skin temperature variations, and temperature variations when the interval of time increases. The second case involves an element of shell covered with a heat insulation layer, with the heat propagated in a direction normal to the surface coating. The temperature variation throughout the thickness of the coating is considered, with the thermal insulation layer divided into a number of sections. Balance equations are compiled for each section. M.G.J.

N66-26130# Joint Publications Research Service, Washington, D. C.
APPROXIMATION CALCULATIONS OF THE HEATING OF A METALLIC SKIN WITH AN OUTER LAYER OF HEAT INSULATION
F. G. Yasinskiy *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 24–32 refs (See N66-26126 14-01) CFSTI: $3.00

A method of approximately determining the temperature of heat-insulated metallic skin is presented. This is based on the division of the entire heating time into intervals, within

the limits of which the heat transfer coefficient from the boundary layer to the skin, and the recovery temperature of the layer as functions of time, are considered constant. A method of approximately calculating thermal conductivity processes is applied to each interval, and simplified expressions are obtained to determine the temperatures of the pressure skin and the outer surface of the heat insulation. Consideration was limited to skin heating of an aircraft whose maximum Mach number in flight does not exceed 4 to 5. M.G.J.

N66-26134# Joint Publications Research Service, Washington, D. C.

CALCULATION OF THE TEMPERATURE DISTRIBUTION THROUGHOUT THE PROFILE OF TURBINE BLADES WITH INTERNAL AIR COOLING

M. N. Bodunov *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 59–70 refs (See N66-26126 14-01) CFSTI: $3.00

A thin-walled blade cooled from inside by air is considered, in which a lateral air flow from the leading to the trailing edge is discharged through slots on the trailing edge. The one-dimensional problem is reduced to solving systems of two differential equations—the heat state of the blade obtained from the heat balance equation, and the preheating of the air in the channel—with the corresponding boundary conditions. These conditions are listed as a known initial temperature of the cooling air; and equality of temperatures; heat flow equality at the boundary between sections; and convective heat transfer at the trailing edge. Solutions for partial and general cases are given. Results indicate: (1) The temperature of the blade does not remain constant throughout its profile. (2) The temperature distribution corresponds approximately to the variation in the local heat transfer coefficients. (3) The maximum values of the temperatures occur in the region of maximum heat transfer coefficients, such as at the leading edge and in the trailing section of the back edge. M.G.J.

N66-26138# Joint Publications Research Service, Washington, D. C.

TEMPERATURE OF COOLED TURBINE BLADES IN A NONUNIFORM GAS FIELD

V. I. Lokay *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 95–105 refs (See N66-26126 14-01) CFSTI: $3.00

The temperature of turbine blades cooled from within and located in a gas flow with a nonuniform temperature is considered. Equations are derived to determine boundary layer temperature of working blades, and a differential equation is formulated for the temperature field of a cooled blade. Certain simplifications are introduced, and approximation solutions are recommended. Temperature variations of the cooling air throughout the blade height are also considered. It is pointed out: (1) Under real conditions, the nonuniformity of the gas temperature at the outlet from the combustion chamber may be observed both around the circumference of the turbine wheel and through the height of the flow section. (2) A temperature field which is uniform throughout the blade height is not the best, as the mechanical properties of critical blade materials are not fully used. (3) Temperature in the boundary layer of the working blades, which determine their temperature state, varies with height. M.G.J.

N66-26141# Joint Publications Research Service, Washington, D. C.

HEAT TRANSFER IN A PULSATING FLOW OF AN INCOMPRESSIBLE FLUID

Yu. A. Sozin *In its* Aviation Eng., No. 2, 1963 22 Jun. 1965 p 126–136 refs (See N66-26126 14-01) CFSTI: $3.00

The effects of fluid velocity pulsation on the basic parameters of heat transfer are theoretically evaluated. It is assumed that for a pulsating flow at any moment of time, a ratio between the heat transfer coefficients and the velocity obtained for a steady flow within a tube is valid. Equations are derived for a case of sinusoidal pulsations of velocity, and for the phase effect of heat transfer reduction in velocity pulsations. Formulas are also derived for calculating the phase effect in a distribution; variations in both the magnitude and in the phase of the pulsating temperature with the distance from the surface of each transfer are considered. M.G.J.

N66-26159# Joint Publications Research Service, Washington, D. C.

EFFECT OF ELECTRICAL FIELDS ON HEAT-EXCHANGE IN LIQUIDS AND GASES

N. F. Baboy, M. K. Bologa, and K. N. Semenov *In its* Electron Treat. of Mater. 2 May 1966 p 62–79 refs (See N66-26150 14-34) CFSTI: $4.00

This article presents a review of investigations on the effects of electric and magnetic fields on heat transfer in liquids and gases. It includes an examination of factual material, relationships connecting experimental results, and certain theoretical prerequisites. Experimental data are cited in an attempt to shed some light on the nature of the electric and magnetic field effects, to disclose new regularities, and to develop specific recommendations for their practical application. R.N.A.

N66-26188# Los Alamos Scientific Lab., N. Mex.

SURVEY OF LOS ALAMOS AND EURATOM HEAT PIPE INVESTIGATIONS

W. A. Ranken and J. E. Kemme [1965] 12 p refs Presented at the IEEE Thermionic Conversion Specialist Conf., San Diego, Calif.

(Contract W-7405-ENG-36)

(LA-DC-7555; CONF-651049-3) CFSTI: HC $1.00/MF $0.50

A review is presented of investigations of heat pipes for thermionic diode uses. The theory of heat pipes is presented. Experimentally obtained properties of heat pipes and several possible pipe designs are discussed. NSA

N66-26311# Wisconsin Univ., Madison. Mathematics Research Center.

THERMOCOUPLE CORRECTIONS FROM IRREVERSIBILITY THEORY

R. A. Gaggioli and J. W. Mitchell Jan. 1966 14 p refs (Contract DA-11-022-ORD-2059)

(MRC-620; AD-630750) CFSTI: HC $1.00/MF $0.50

The resultant error introduced by using finite impedance measuring instruments in thermocouple circuits was determined quantitatively and rigorously. The standard-practice correction formula to account for finite impedance of measuring instruments in the thermocouple circuits is valid (provided there are no excessive radial temperature and voltage gradients). The measured voltage can be corrected to give voltage values for use with standard tables. The analysis shows that error is reduced by decreased thermocouple circuit resistance R (TC) (including all lead wires) and increased instrument impedance (internal impedance of instrument alone). The effect of the temperature dependence of the electrical conductivity and the absolute thermoelectric power are exactly accounted for by an equation which requires that the total resistance R (TC), which is dependent upon the temperature variation along the wires, be determined. A procedure was also indicated that minimizes the effect of unequal lead-wire junction temperatures. TAB

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N66-26359# ARO, Inc., Arnold Air Force Station, Tenn.
SCALING OF ISOTHERMAL SIMPLE-SHAPED BODIES IN A TRANSIENT TEMPERATURE ENVIRONMENT Technical Report, 1–15 Jun. 1965
D. L. Adkins Arnold Eng. Develop. Center, Apr. 1966 24 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-21; AD-630901) CFSTI: HC $2.60/MF $0.50

Thermal modeling was performed with a flat plate, sphere, and cylinder. The aluminum bodies were located in a relatively close array. Electrical resistance heaters in the plate and sphere provided the external heat sources. The temperature distributions on the body surfaces were small enough to permit an isothermal assumption. A theoretical design analysis of the system was conducted and is discussed. Chamber testing consisted of eight continuous hours of 2-hr intervals of heating and cooling cycles in a pressure range of 0.0000001 torr. Author (TAB)

N66-26392# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleairs.
METHOD FOR CALORIMETRIC ANALYSIS IN VARIABLE CONDITIONS [METHODE D'ANALYSE CALOMETRIQUE EN REGIME VARIABLE]
Guy Berthier Nov. 1965 99 p refs In FRENCH
(CEA-R-2797)

It is reported that by analysis of the transitory thermal conditions given by the quenching of a sample in a furnace maintained at a high temperature, it is possible to study the thermal diffusivity of some materials, and that of solid state structure transformation on a qualitative as well as quantitative standpoint. As examples, the transformation energy of α-quartz into β-quartz and the Wigner energy stored within neutron irradiated beryllium oxide were measured. Author (NSA)

N66-26464# Darmouth Coll., Hanover, N. H. Thayer School of Engineering.
TWO-PHASE FLOW AND BOILING HEAT TRANSFER. BUBBLY FLOW IN STRAIGHT PIPES Interim Report
P. E. Meyer and G. B. Wallis Nov. 1965 48 p refs
(Contract AT(30-1)-3114)
(NYO-3114-12; EURAEC-1530) CFSTI: HC $2.00/MF $0.50

An investigation was made on existing non-accelerated and accelerated bubbly flow data. Homogeneous flow theory was applied to all the data using an existing correlation for the frictional pressure drop. Total pressure drop data are correlated within an absolute error of 20 lb/ft^2, the total pressure drops ranging from −20 to 220 lb/ft^2. Effects not included by this simple correlation are discussed. Homogeneous theory was applied to the non-accelerating horizontal data in an attempt to correlate frictional pressure drop. The results point to non-Newtonian flow characteristics of bubbly mixtures as a possible consideration. Various rheological techniques and models are discussed in relation to possible correlations. Author (NSA)

N66-26481# Aerojet-General Nucleonics, San Ramon, Calif.
ALKALI METALS EVALUATION PROGRAM. FORCED CONVECTION CONDENSING HEAT TRANSFER FOR RUBIDIUM AND CESIUM
C. R. Fisher and J. H. Moskowitz Jan. 1966 73 p refs
(Contract AT(04-3)-368)
(AGN-8162) CFSTI: HC $3.00/MF $0.75

Investigations were made of the heat transfer characteristics of rubidium and cesium under conditions of forced convection condensation in a round tube in both vertical and horizontal orientations. The experiments were performed in type 316 stainless steel loop, with a nickel test section. Data were obtained at temperatures up to 1360°F. Operating parameters were varied to obtain information useful for the design of condensers for space power systems. The data are presented in tabular form. Experimental uncertainties are discussed in detail. Useful data on thermophysical properties of the fluids studied are presented. Author (NSA)

N66-26495# RAND Corp., Santa Monica, Calif.
THE THERMODYNAMICS OF THE ZIRCONIA/ZIRCONIUM-OXYGEN VAPOR SYSTEM
F. J. Krieger Feb. 1966 34 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4907-PR; AD-629570) CFSTI: HC $2.00/MF $0.50

The study reports the thermodynamic investigation of zirconia, ZrO_2, over a range of temperatures up to 6000°K and pressures up to 1000 atmospheres. Two sets of equilibrium composition equations are used—one representing a pure gas phase, the other a heterogeneous system of gas and condensed (i.e., solid or liquid) zirconium. The gas phase of the heterogeneous chemical system, like the homogeneous gas phase, comprises five gaseous zirconium-oxygen species. The results of the computational program are presented in both tabular and graphic form. The latter is a conventional Mollier diagram in which specific enthalpy is plotted against specific entropy, with cross plots of temperature, pressure, and molecular weight or moles of condensed zirconia. Author (TAB)

N66-26573# Applied Physics Lab., John Hopkins Univ., Silver Spring, Md.
TWO NEW COATINGS FOR SATELLITE TEMPERATURE CONTROL
Paul R. Schrantz Dec. 1965 25 p refs
(Contract NOw-62-0604-c)
(TG-758; AD-630036) CFSTI: HC $2.60/MF $0.50

The report describes in detail the preparation, properties, and qualification testing of two new coatings for use in satellites that are exposed to extraterrestrial solar irradiance. The first is a black coating, called APL Conductive Black No. 100, which was developed at The Applied Physics Laboratory for use on the DME-A satellite, launched in late 1965. The second coating is presently in the development stage and is produced by the application of a number of dielectric-coated second-surface silver mirrors to the surface of the satellite. Although this type of coating has not been selected for any particular APL satellite, it appears likely that it could result in a significant breakthrough in the field of stable low a/e (ratio of solar absorptance, a, to infrared emittance, e) coatings for use in extraterrestrial space. Author (TAB)

N66-26579# Midwest Research Inst., Kansas City, Mo.
MATERIALS RESEARCH FOR HEAT TRANSFER FLUIDS Technical Report, Jun. 1964–Jun. 1965
Karl R. Mecklenburg Feb. 1966 37 p refs
(Contract AF 33(657)-10295)
(ML-TDR-64-16, Pt. IV; AD-629960) CFSTI: HC $2.00/MF $0.50

Liquid metals have certain properties that make them candidates for heat transfer use in aerospace systems. The objective of the investigation was to determine the magnitude of the heat transfer coefficient of condensation for sodium. Design factors and program organization are discussed, and a description of the equipment is presented. The heat transfer experiments were conducted in a closed boiler system, in which the sodium was boiled in the lower region and condensed upon an instrumented surface in the upper region. Operational techniques and history are discussed, including the massive, premature failure of the condensing section. The 1700°F

sodium leaked into the 500°F cooling air passage and generated a considerable amount of dense smoke before complete shutdown of the equipment. Only three data points were obtained. The heat transfer coefficients for condensing sodium ranged from 79.8 to 473.6 Btu/hr-sq. ft-°F for heat fluxes of 7,683 to 24,083 Btu/hr-sq. ft. A sample calculation is presented. The boiler material showed satisfactory corrosion resistance to sodium but not to the sodium and air reaction. Differential thermal expansion apparently loosened the special surface thermocouples, allowing the sodium to leak into the coolant passage. Author (TAB)

N66-26636*# Israel Program for Scientific Translations, Ltd., Jerusalem.
UNSTEADY MELTING OF VISCOUS MATERIAL NEAR STAGNATION POINT
J. M. Paskonov and Yu. V. Polezhaev *In its* Numerical Methods in Gas Dyn. 1966 p 85–93 refs (See N66-26626 14-12) CFSTI: HC $5.00/MF $1.00

A theoretical computation of the unsteady breakdown of a viscous glassy material is presented. The equations formulated for describing the moving film have the ordinary form of equations for a laminar boundary layer; the flow is regarded as incompressible; and specific heat and heat conductivity are assumed constant. The standard computer program for solving boundary value problems was used, and several variations to it are discussed. A table of alternative calculations is included. Data are plotted to depict the rate of ablative mass loss vs. time in various alternatives, surface temperature of liquid film vs. time in various alternatives, and the effect of material properties and incident flow parameters on the unsteady temperature profile. Numerical results show: (1) The time required to reach equilibrium between the processes of heating, heat conduction, and heat transfer by the liquid phase may be 10 seconds and more. (2) The time required to reach steady surface temperature is much lower than that corresponding to the ablation rate. M.G.J.

N66-26691*# Northrop Space Labs., Hawthorne, Calif.
RESEARCH AND DEVELOPMENT STUDY ON THERMAL CONTROL BY USE OF FUSIBLE MATERIALS Final Report, Mar. 1964–Mar. 1966
E. W. Bentilla, K. F. Sterrett, and L. E. Karre Apr. 1966 70 p refs
(Contract NAS8-11163)
(NASA-CR-75041; NSL-65-16-1) CFSTI: HC $3.00/MF $0.75 CSCL 20M

Specific design data were developed for applying the solid-to-liquid phase change concept to spacecraft temperature control, and details are given on system concepts and packaging techniques for incorporating this method into thermal control subsystems. The criteria for selecting fusible n-paraffin materials are defined, and the techniques used to analyze their performance in the simple adiabatic, and radiating fin temperature control system concepts are described. System improvement studies resulted in the development of rigid packages with metallic filler materials for more efficient thermal diffusivity at reasonable weight penalties. Fundamental theories of nucleation and supercooling are described, and experimental data on the effects of weightlessness on the melting and solidification process are tabulated. The phase equilibria of binary normal aliphatic hydrocarbon systems were also studied. It was concluded that the incorporation of fusible material heat sinks in temperature control systems can greatly increase the systems' thermal inertia and reduce temperature excursions caused by high density power pulses. M.G.J.

N66-26769# Academy of Sciences (USSR), Moscow.
ON THE SHAPE OF HEAT REJECTING ELEMENTS COOLED BY RADIATION. PART IV: THE EQUILIBRIUM FORMS AND SMALL VIBRATIONS OF A FLEXIBLE THREAD ROTATING IN THE FORCELESS FIELD. THE LIMITARY CHARACTERISTICS OF A BELT RADIATOR WITH MUTUAL IRRADIATION. THE OPTIMUM SYSTEM OF HEAT REJECTING FINS WITH MUTUAL IRRADIATION
G. L. Grodzovsky, A. L. Stassenko, and V. V. Frolov [1964] 31 p refs
CFSTI: HC $2.00/MF $0.50

Previous parts of this investigation have dealt with determining the form of a flexible heat exchange belt (a flexible thread) in the centrifugal force field and the optimum contour of the heat rejecting fins. This paper discusses all the equilibrium forms of the rotating flexible belt and outlines the domain of parameters within which the thread has no cross-points. Small vibrations about the equilibrium form are also considered. It is shown that the equation for the proper functions is that of Lame, if the thread is of small curvature and the tension is large. For the straight equilibrium form of the thread, the equation reduces to the equation of Legendre and the proper functions are written in integral form. The limitary optimum heat transfer characteristics, corresponding to the two limitary cases of radiant interference, are presented. The characteristics depend only on two dimensionless parameters and the rest of the characteristics are placed between the two. The two-dimensional variational problem of optimum contour of thin heat rejecting fins is considered, taking into account the fins' mutual irradiation, the interference between the fins, and the base prism surface for any emissivity. R.N.A.

N66-26858*# Oklahoma State Univ., Stillwater.
DESIGN CONSIDERATIONS FOR THERMOSTATIC FIN SPACECRAFT TEMPERATURE CONTROL
J. A. Wiebelt, C. A. Morgan, and G. J. Kneissl Washington, NASA, May 1966 34 p refs
(Grant NsG-454)
(NASA-CR-500) CFSTI: HC $2.00/MF $0.50 CSCL 20M

An analysis was conducted on a passive–active thermal system for use on spacecraft. The system consists of thermostatic fins which react to local temperature causing a variation in the ratio of solar absorptance to terrestrial emittance. Emittance of the fins in the closed or partially closed position, a suggested design technique, a thermal model of a thermostatic finned surface, and solar energy fluxes are discussed. To validate the thermal analysis technique, a test model of the finned spacecraft surface was constructed. The test spacecraft surface and associated test system are described. As a result of preliminary tests and calculations, it was concluded that the test apparatus should be changed. It was also determined that the fins of the system are not thermally coupled to the base plate. R.N.A.

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N66-25447# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
"STABLE 60" TYPE FOAMING FIRE EXTINGUISHER [SCHUIMVORMEND BRANDBLUSMIDDEL STABIEL 60]
E. W. Lindeijer 15 Feb. 1966 23 p In DUTCH
(TL-1966-6; TDCK-44756) CFSTI: HC $1.00/MF $0.50

Research was conducted to determine if a foaming fire extinguisher meets American specification for use in the armed forces. Analytical testing revealed that in the areas of sedimentation and precipitation the product does not meet the specifications required. However, the product as a whole has been accepted by the American armed forces installations. Transl. by J.O.

N66-25488# India. Dept. of Atomic Energy, Bombay. Waste Treatment Div.
THE USE OF INCINERATORS FOR TREATMENT OF COMBUSTIBLE WASTES
R. V. Amalraj and A. A. Khan 1965 19 p refs
(AEET-220) CFSTI: HC $1.00/MF $0.50

In contrast to all other methods for the disposal of combustile wastes, incineration alone meets the exacting health standards. While there is as yet no ultimate incinerator design, engineers continue to strive for ever greater efficiency. For case of management of combustible wastes, a generally accepted classification is followed based on which the selection of an incinerator is made. Population booms, rapid industrialization and increasing land values in leading Indian cities should focus the attention of the public health experts on the pressing need for the utilization of incinerators for effective and economical waste disposal purposes. Author

N66-25672# Martin Co., Orlando, Fla.
MAINTAINABILITY ENGINEERING
John Geise (Pittsburgh Univ.) and Walker W. Holler (Duke Univ.) 1965 275 p refs Prepared in cooperation with Duke Univ.
(Contract DA-31-124-ARO-(D)-100-34)
(AD-630131) CFSTI: HC $6.00/MF $1.50

This text has been developed to satisfy several objectives. The first objective is to satisfy the requirement for a textbook, to be used in university curricula, that will acquaint future engineers with the requirements for maintainability in the products they may eventually design. The second objective is to provide a standard textbook for use by practicing engineers who may wish, through self-study, to expand the boundaries of their professional thinking. The third of these is to provide a standard reference work for use by: Contracting personnel, who must specify and define the product requirements. Design engineers, who must choose the parts and integrate them into operational systems that meet product requirements. Maintainability engineers, who must assure their companies and the customers that the products represent not only the optimum for satisfying the demands of the market, but also that they will survive in their environment. TAB

N66-25761# Joint Publications Research Service, Washington, D. C.
TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY, No. 316
18 May 1966 57 p refs Transl. into ENGLISH from Chinese periodicals
(JPRS-35584; TT-66-32019) CFSTI: $2.00

CONTENTS:

1. A DISCUSSION ON THE MIXING OF BOUNDED WATER MASSES Sau Hsu, Hsi-hou Wang, and Jen-shu Wang p 1-25 refs
2. NEWLY PRODUCED HIGH-EFFICIENCY VACUUM PUMPS p 26
3. INVENTION OF TWO DUST-PROOFING FACILITIES p 27-28
4. COMPLETION OF SCIENTIFIC RESEARCH TASKS Sheng-mei Lo and Mu-sheng Li p 29-34
5. STELLAR ASTRONOMY Wen-sai Tai p 35-46

N66-25783# Joint Publications Research Service, Washington, D. C.
STATUS AND OUTLOOK IN RADIOASTRONOMICAL AND CYBERNETIC RESEARCH
17 May 1966 12 p Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. RSR (Kiev), no. 1, 1966 p 129-132
(JPRS-35563; TT-66-31998) CFSTI: $1.00

Research activities in radioastronomy and cybernetics at the Ukrainian Academy of Sciences are briefly reviewed in terms of specific projects, general progress made, and overall outlook. Mention is made of the construction of a large T-shaped radiotelescope, several digital computers, quasi-analog simulation and other mathematical techniques, and information systems. M.W.R.

N66-25882# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.
COMMENTS ON TECHNICAL PROGRESS
Ronald W. Jones (Rochester Univ.) 31 Jan. 1966 31 p refs (Contract Nonr-225(50))
(TR-140; AD-630487) CFSTI: HC $2.00/MF $0.50

Various means of classifying technical progress are discussed, and three alternative sets of parameters to define the extent and bias of such progress are developed. Interrelationships are pointed out between these parameters, which deal with (1) changes in marginal products, (2) changes in input-output coefficients, and (3) the use of augmenting coefficients applied to the inputs in a production function. Classifications of bias suggested by Hicks and Harrod are discussed, primarily to demonstrate that there is a basic symmetry between the two approaches that is not evident in usual formulations. The concept of aggregate neutrality in a two-sector model is considered, and related to the Hicks and Harrod schema. M.W.R.

N66-25913# Library of Congress, Washington, D. C. Aerospace Technology Div.
PROTECTIVE STRUCTURES AND COMPONENTS Surveys of Communist World Scientific and Technical Literature
Victor Klein Jan. 1966 29 p refs Compilation of abstracts
(ATD-66-3; AD-630325) CFSTI: HC $2.00/MF $0.50

An annotated bibliography with abstracts was compiled in response to the following areas of interest: (1) facilities; (2) transportation; (3) launch sites; and (4) packaging, preservation, and storage. Also, information is presented on: (1) special heavy duty tractors; (2) road building under arctic and permafrost conditions; (3) snow compacting machines; (4) ships and barges; and (5) waterways. D.T.

N66-26084# Congress. House. Committee on Science and Astronautics
1967 NASA AUTHORIZATION, NO. 4, PART 4
Washington, GPO, 1966 742 p Hearings before the Subcomm. on Advanced Res. and Technol. of the Comm. on Sci. and Astronautics, U.S. House of Representatives, 89th Congr., 2d Sess. on H.R. 12718 (Superseded by H.R. 14324), 23–25, 28 Feb., 1–3, 7–8 Mar. 1966

This report presents the proceedings of the hearings before the Subcommittee on Advanced Research and Technology of the House Committee on Science and Astronautics concerning the authorization of NASA funds for the fiscal year 1967. R.N.A.

N66-26150# Joint Publications Research Service, Washington, D. C.
ELECTRONIC TREATMENT OF MATERIALS, NO. 1, 1965
2 May 1966 119 p refs Transl. into ENGLISH from Elektronnaya Obrabotka Materialov (Kishinev), no. 1, 1965 p 3–94
(JPRS-35288; CFSTI: $4.00

CONTENTS:

1. NEW APPLICATIONS FOR ELECTRICITY IN INDUSTRY AND AGRICULTURE B. R. Lazarenko p 1–10 (See N66-26151 14-15)

2. THE METHOD AND EQUIPMENT FOR THE INVESTIGATION OF ELECTRIC EROSION BY REPEATED DISCHARGES A. A. Namatevs and G. A. Ostroumov p 11–15 refs (See N66-26152 14-15)

3. RELATIONSHIP BETWEEN THE EROSION OF BIMETALLIC ELECTRODES AND THE PLACE WHERE THE DISCHARGE BEGINS I. G. Nekrashevich and I. A. Bakuto p 16–20 refs (See N66-26153 14-09)

4. THE MEDIA FOR ELECTRO-EROSION TREATMENT OF METALS A. N. Merkur'yev, N. S. Pechuro, L. A. Royter, V. N. Gol'din, and O. Yu. Pesin p 21–38 (See N66-26154 14-15)

5. ELECTRO-EROSION PRECISION TREATMENT OF METALS IN A MEDIUM CONTAINING NO CARBON Ye. V. Kholodnov p 39–50 refs (See N66-26155 14-15)

6. ELECTROCHEMICAL METHOD OF GRINDING METAL-CERAMIC ALLOYS Y. Stanek, M. S. Ing, Y. Zubak, and Y. Zhukha p 51–53 (See N66-26156 14-15)

7. THE PLATING MECHANISM IN ELECTROSPARK ALLOYING OF SURFACES N. I. Lazarenko p 54–58 refs (See N66-26157 14-15)

8. THE ELECTROSPARK METHOD OF IMPROVING THE DURABILITY OF THE CUTTING UNITS OF AGRICULUTRAL MACHINES Yu. N. Petrov, I. I. Safronov, and S. P. Fursov p 59–61 (See N66-26158 14-15)

9. EFFECT OF ELECTRICAL FIELDS ON HEAT-EXCHANGE IN LIQUIDS AND GASES N. F. Baboy, M. K. Bologa, and K. N. Semenov p 62–79 refs (See N66-26159 14-33)

10. ELECTROCHEMICAL PRESSURE PICKUPS B. R. Lazarenko, S. P. Fursov, and A. A. Faktorovich p 80–82 refs (See N66-26160 14-14)

11. ELECTRICAL STRATIFICATION OF GRAFTED GRAPE PLANTS L. V. Kolesnik, G. M. Fedorishchenko and N. Ye. Fedorenko p 83–86 refs (See N66-26161 14-34)

12. ULTRAVIOLET RAYS FOR PROTECTION OF PLANTS M. I. Zhigal'tseva and S. M. Chernobrovina p 87–91 ref (See N66-26162 14-04)

13. ELECTRICAL FLOTATION OF SUBSTANCES B. M. Matov p 92–95 ref (See N66-26163 14-15)

14. ELECTROSPARK METHOD USING UNPROFILED ELECTRODES FOR MAKING PRECISION BLANKING DIES V. P. Smolentsev p 96–101 refs (See N66-26164 14-15)

15. THE VUMA-VJK-4 ELECTROSPARK UNIT p 102–104 (See N66-26165 14-15)

N66-26161# Joint Publications Research Service, Washington, D. C.
ELECTRICAL STRATIFICATION OF GRAFTED GRAPE PLANTS
L. V. Kolesnik, G. M. Fedorishchenko, and N. Ye. Fedorenko *In its* Electron. Treat. of Mater. 2 May 1966 p 83–86 refs (See N66-26150 14-34) CFSTI: $4.00

An electrical stratification method is described for increasing the yield of excellent plantings of grafted grape plants from the nursery. With this method, the thermal conditions for stratification must be differentiated, depending on the biological properties of the wilding. The use of the electrical stratification method in the nursery definitely improves the quality of the grafted material, reduces the consumption of electric power for heating, and requires less manual labor. R.N.A.

N66-26332# Frankford Arsenal, Philadelphia, Pa. Propellant Actuated Devices Div.
DEVELOPMENT OF M117 BOMB PARACHUTE RETARDATION DEPLOYMENT SYSTEM
Bruce W. Travor Dec. 1965 38 p refs
(R-1791; AD-630242) CFSTI: HC $3.60/MF $0.50

As a means of achieving a controlled rapid ejection-retardation effect for correct deployment of the M117 bomb, Frankford Arsenal developed a propellant-powered parachute system capable of obtaining the specific velocity-time sequence required to properly retard the foreward velocity and descent of the bomb. The work performed included the design of a bomb tail section containing the parachute and deployment system, ballistic tests to establish a propellant charge, and the manufacture of test devices for an aerial drop program. The test devices were assembled to M117 bombs at Kirtland Air Force base and successfully subjected to ground testing and partially successfully to aerial drop testing. Author (TAB)

N66-26411# Texas A&M Univ., College Station. Inst. of Statistics.
INTEGRAL OPERATORS FOR PERT SUB NETWORKS
Technical Report No. 2
Larry J. Ringer 23 Mar. 1966 12 p ref
(Grant DA-31-124-ARO(D)-282)
(AROD-4721-3; AD-630841) CFSTI: HC $1.60/MF $0.50

An algorithm was previously developed for computing the cumulative distribution of the completion time for certain PERT networks. These networks (which are termed 'multiple crossed') are composed of certain simple sub-networks: (a) two activities in series, (b) several activities arranged in parallel, and (c) five activities arranged in 'Wheatstone Bridge' configuration. In this note an extention is made to the concept of a 'multiple crossed' network by adding two additional sub-networks as building blocks to the three mentioned. Included is the development of integral operators for the 'double Wheatstone Bridge' and the 'criss-cross'. C.T.C.

N66-26617# Illinois Univ., Urbana. Group Effectiveness Research Lab.
THE SIGNIFICANCE OF ROLE BEHAVIOR DIFFERENTIATION FOR CROSS-CULTURAL INTERACTION TRAINING
Uriel G. Foa and Martin M. Chemers Mar. 1966 26 p refs
(Contract DA-49-193-MD-2060)
(TR-22; AD-630796) CFSTI: HC $2.00/MF $0.50

In order to train people to deal effectively with persons from another culture, it appears necessary to identify cross-differences which are critical to the working of culturally heterogeneous groups. A theoretical analysis of the development of role differentiation, within and between social systems, in traditional and modern cultures, leads to the hypotheses that traditional cultures stress differentiation of the roles of the same system, while modern culture tends to emphasize differentiation of comparable roles of different systems. These hypotheses were tested on the content of a cultural training program found to be effective in improving an individual's performance and interpersonal relations in heterocultural task groups. This training program is composed of 55 problem episodes to be interpreted for causes of conflict by the trainee. The problem episodes were derived from 'critical incident' interviews with individuals who had had cross-cultural experience, as well as from the relevant literature on the target culture, the Middle East. The results support the hypotheses and suggest that role differentiation may constitute an important area for cross-cultural training. A facet analysis of the content of the training program is presented and used in formulating proposals for a systematization of the program. Author (TAB)

N66-26729# University of Electro-Communications, Tokyo (Japan).
REPORTS OF THE UNIVERSITY OF ELECTRO-COMMUNICATIONS, NO. 17
Dec. 1964 117 p refs In JAPANESE and ENGLISH
CFSTI: HC $4.00/MF $0.75

Scientific and technological activities in electronics and solid state devices for communications are reported. The following investigations are included: energy exchange among nonlinearly coupled oscillators; (2) coupling between X-band surface wave transmission lines; (3) temperature dependency of silicon control rectifier gate characteristics; (4) thermistor dc current effects in a bridge oscillator; (5) elasticity under plastic bending with tension; (6) intensity distribution in the Lyman–Birge–Hopfield system of nitrogen; and (7) equation for the propagation velocity of flameless combustion along a thin board. D.T.

N66-26749*# Massachusetts Inst. of Tech., Cambridge.
RESEARCH IN MATERIALS, SCIENCE AND ENGINEERING Annual Report 1965–1966
Apr. 1966 591 p refs
(Contracts NAS8-11091; NAS9-3079; NAS9-4065; Grants NGR-22-009-075; NGR-22-009-091 et al)
(NASA-CR-75156) CFSTI: HC $8.91/MF $2.75 CSCL 20

Continuing research is reported on chemical and solid state physics; metallurgy and materials science; materials engineering; plasma physics; magnetic fields; crystallography; low temperature physics; semiconductor materials and devices; electric, magnetic, and optical properties; and space environmental effects. Personnel in the facilities, and the reports published are listed. N.E.N.

N66-26780# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
REVIEW OF LITERATURE ON INDUSTRIAL SCIENCE [LITERATUUROVERZICHT DEDRIJFS WETENSCHAPPEN]
13 Apr. 1966 32 p refs In DUTCH, ENGLISH, FRENCH, and GERMAN *Its* Vol. 5, No. EM-97 CFSTI: HC $2.00/MF $0.50

Abstracts and bibliographic notes are presented on the topics of general economy, industrial economy (including internal organization, cost analyses, financing, administration, and statistics), personnel (including planning, evaluation, and leadership), and logistics (including acquisitions, storage and moving, and materials planning and control). Transl. by J.O.

N66-26846*# National Aeronautics and Space Administration, Washington, D.C.
A SELECTED LISTING OF NASA SCIENTIFIC AND TECHNICAL REPORTS FOR 1965
Mar. 1966 1402 p refs
(NASA-SP-7024) GPO: HC $2.00; CFSTI: MF $10.00 CSCL 05B

This document contains a selected listing of NASA scientific and technical reports for 1965 that were previously published in STAR, NASA's semimonthly announcement journal for the aerospace sciences. Included are bibliographic citations and abstracts arranged by subject categories, and indexes by subject, corporate source, personal author, report/accession number, and accession/report number. R.N.A.

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